J. Nelson Spaeth.

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VOL. XXX DECEMBER, 1932 No. 8

The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it. Editorials are by the Editor-in-Chief unless otherwise indicated and do not necessarily represent the opinion of the Society as a whole. The "leaders" preceding major articles are to be regarded as editorial additions.

EDITORIAL

A CHANGE IN SYSTEM OF TAXING OLD-GROWTH SORELY NEEDED

THE application of the general property tax system to old-growth timber will be under fire this coming year as never before. A strong bid will be made by western timber owners for the substitution of a severance tax. For a long time timber owners have attacked the present system, but up until the past decade the tax on virgin timber was not very burdensome and the protests consequently not vigorous. Now, however, after a decade of pyramiding of public expenditures and the consequent increase in taxes, standing timber has been assessed so heavily that the taxes accumulated over a period of years make up an inordinate proportion of the value of the stumpage. The effect of this heavy tax burden is especially severe now that timber owners find it difficult to market, profitably, enough forest products to obtain funds for paying tax bills. With less timber being cut the tax on all their standing timber apportioned to each thousand feet they cut is excessive. Some of our soundest lumber companies are delinquent in tax payments on at least a part of their timber holdings. Perhaps the annual tax bill, except for its uncertainty, is not as serious in all cases as the more inexorable annual bill for interest on borrowed capital, and perhaps, the tax does not always have more than a small influence on overproduction. In certain cases however it is really serious. In some localities, too, there is the temptation to increase the tax on the property to make up for what is lost each year through liquidation, and taxes, therefore, are not so accurately predictable as are fixed charges on borrowed capital. The financial stress of the lumber industry may be largely a matter of its being overbuilt, the character of timber ownership and the imprudent size of investment. Nevertheless, even in those cases where the owner has little or no bonded indebtedness the tax bill contributes importantly to the total problem of keeping a property intact during business depressions. It might be expected, therefore, to have some bearing upon the possibilities of forestry practice or upon the owner's interest in it.

The increased demand on the part of timber owners for an improved system of taxing old growth, comes at a time when in many businesses there is a general loss of faith in the property tax and an increased interest in a tax that is better suited to actual production or income.

Timber owners, however, should not deceive themselves into hoping for a major change in the tax system in time to be of help during the present emergency. Timber is only one of the resources affected; the entire present tax system is more and more being looked upon as unsound when applied to natural resources. To change to a severance tax is a complicated matter, and many adjustments would have to be made while it is gradually put into effect. It will take much intelligent work to educate the people to accepting a severance tax on old growth. The public was but little opposed to a yield tax on young growth, because in most counties this tax amounted to practically nothing. It will be vastly different in promoting a severance tax on old growth. An important objection to a severance tax is its irregularity. This alone will likely make the public, and county officials in particular, apprehensive, if not hostile. In years of heavy timber cutting the return may be more than ample to meet the needs of government while in years when very little cutting is going on there may be an insufficient amount. Tax economists, however, believe that the apprehension of irregularity of an income tax is not valid. Certainly the present economic depression has shown that a property tax itself is irregular because it too must be paid out of income. If there is no income or one so small as to be barely enough to keep a business intact or body and soul together the property tax will not be paid and confiscation by the public is invited. This applies equally well to a severance tax on timber, since it is really a form of income tax. It may be argued also that if a property tax is burdensome during depressions it is doubtless too light during times of prosperity. The income tax has this tremendously important fact in its favor—it is consonant with ability to pay. In comparison, the property tax is considered inconsistent and incongruous. It might be considered too idealistic to pr pose a reserve fund in the county fina cial set-up, much as a business has suc a fund, to be swelled in good years an drawn upon in lean years. Perhaps o public conscience has not yet advance enough to make such a fund practicabl —or safe.

It would seem impossible to divor any argument for a severance tax on tim ber from the application of this type tax to other resources. To promote th plan solely for timber has the disadva tage of raising the suspicions of the pu lic. As suggested above, it will not l easy to convince the western timber cou ties that the system of taxing old grow should be changed. They will ask som pointed questions concerning the perpe ual security of the tax income from fo ested lands. It would seem, therefor that along with a change in taxation the might be considered a changed system forest land management including le wasteful and more orderly logging, pr duction in harmony with market demand and such handling of forest lands as wi assure their continued productivity an hence permanent community support. Th states and counties are interested pr marily in the permanent development the community and this requires conti nuity of tax income. The program of a tack would seem to include (1) a driv on the present antiquated property ta system in general, not for timber alon (2) a demand for budgeting state an county expenditures in harmony with th tax derivable from the earnings of indu tries; (3) an equitable provision fo equalizing the fat and lean years; and, possible, (4) an agreement by the own that the timber will be harvested, n necessarily according to the forester's su tained yield principle for each operatio but with a view to leaving the land in a ceptable condition for regrowth. Ju what this latter involves cannot be a

swered. Unfortunately we still lack the most vital knowledge of how old growth should be logged. It may not be advisable to confuse the taxation issue by adding a purely forestry issue. Indeed, many feel that the latter should stand on its own feet.

Taxation of old growth has been given much less attention by foresters than that of young growth. Indeed, the management of old-growth timber has been given comparatively little aggressive consideration by the forestry profession. Many foresters still regard old growth as merely a temporary feature in our timber situation which must be removed before forestry can be practiced. Some definitely state that old growth should be taxed the same as other property and that only a young forest warrants a special form of taxation. This is borne out by the fact that within the past 15 years a number of states have passed special forest tax laws that apply only to planted or volunteer trees and such as are left after logging. That these laws have failed to promote the practice of forestry is of interest at this time though it should not be held against their underlying principle so much as that they probably did not go far enough.

Foresters took the initiative in promoting legislation to apply the yield tax principle to young growth and worked assiduously for the passage of the various state bills. They might, with equal propriety, study this proposed extension of the principle to old growth. The yield tax on young growth was regarded as a necessary encouragement to the practice of forestry. If a change to a severance tax on old growth results in closer utilization and discourages even a little overcutting it will have its bearing on forestry too. The fact that some foresters may not believe that the tax load is the most pressing one to be alleviated should not operate against their studying the possibilities of the proposed change. Unfortunately the report of the federal Forest Taxation Inquiry is not yet available, though its early release is promised. However, many things may happen to delay its appearance. It is quite possible that the Inquiry's report will offer viewpoints not touched upon here. When it is released it will be given extended space in this JOURNAL. Until then it seems advisable to broach the subject without delay so that foresters can begin getting acquainted with the issues. Certainly a wise solution of the tax problem in the near future is imperative if we are ever to have any private forestry at all. We cannot afford to delay longer.

THINNING JACK PINE IN THE NEBRASKA SAND HILLS[1]

By J. ROESER, JR.

Assistant Silviculturist, U. S. Forest Service, Colorado Springs, Colo.

Two remeasurements of thinning plots in the Nebraska National Forest jack pine plantations of 1903 indicate that the heavily thinned stand with 696 trees per acre has made a gain in volume of 58 per cent compared with the unthinned stand with 2,098 trees per acre. The moderately thinned stand with 1,480 trees has made a 41 per cent gain, and the lightly thinned with 896 trees a 31 per cent gain. Both the accelerated growth and the stronger wood structure, as results of thinning, suggest the advantage of heavy thinnings to concentrate the growth on a smaller number of individual trees which will have a more nearly sufficient supply of moisture.

ON APRIL 26, 1902, an area of 206,000 acres was set aside in north-central Nebraska by presidential proclamation and dedicated to the working out of a comprehensive experiment in forestation. It was named the Nebraska National Forest. The two divisions of "the Forest," although 50 miles or more apart, are both entirely within the sand hills region which includes about 20,000 square miles in Nebraska. Stock raising is the chief industry of the region—in fact, the only industry of any importance. As a general rule the prevailing physical conditions preclude the possibility of successful agricultural development, although there has been a continued demand for the forage resource.

The average annual precipitation varies between 16 and 23 inches. Monthly mean temperatures range from 26.3° to 75.5°F.; extremes go as low as 30° below zero and as high as 100° above. Sudden decided changes are common and the precipitation is erratic.

Except along the primary drainage channels the geomorphology generally is suggestive of desert terrain. The soil is derived from the tertiary deposits of Arikaree sandstone which have been exposed in Wyoming, North and South Dakota, Nebraska, Kansas, and other parts of the western plains. While some of the soil may have been formed from unde lying beds, apparently most of it consis of œolian deposits—the light, fine-grain constituent particles having been blown from the north and northwest. As a r sult of wind action, the sand hill soils extremely homogeneous in compositi and of indefinite depth—are lower in fe tility than the residual soils of simil origin because the finer, more retenti colloidal materials found in the latter, a largely absent here. Essential minera with the possible exception of potash a iron, are present in only small quantiti

In general there is not much differen between the extremes of elevation, a there are no areas of rough topograp although in the vicinity of the Bessey I vision, south of the Middle Loup Riv the topography is marked by rath "choppy" ridges and alternating valle extending generally east and west w surprising uniformity. The land surfa within the Niobrara Division in the treme northern part of the State is sim lar to that within the Bessey Divisi except for occasional wide flats separat by rough, choppy ridges. Except in breaks along the larger streams, wh there is some native tree growth, the ve tation of this region consists of herbaceo growth—chiefly grasses and shrubs.

The first trees were planted here

[1]Presented before the Southwestern Division, American Association for the Advancement Science, in Denver, April 26, 1932.

1903, when a quantity of forest-grown seedlings of ponderosa pine (*Pinus ponderosa*) from the Black Hills, and of jack pine (*Pinus banksiana*) from Minnesota were set out. A nursery was established the year before on the Middle Loup River near Halsey, where the growing of trees from seed was begun. This nursery has been increased steadily in size and efficiency until at present the output is about 3,000,000 trees each year. Most of the stock produced has been planted in the hills immediately south of the nursery. The area successfully planted on the two divisions of the Forest is 11,000 acres.

Ponderosa pine is considered to be the most valuable tree for planting here, since it is the only typical forest-tree species which is indigenous with the exception of eastern red cedar (*Juniperus virginiana*). Jack pine, though not indigenous, ranks next to ponderosa pine in importance. While other species, all more or less exotic, are being eliminated from the future planting program, jack pine is still extensively planted even though it is considered of value chiefly from the standpoint of a more or less temporary cover—rather than from the standpoint of a permanent source of timber supply. It becomes established and develops under the adverse conditions of the sand hills with comparative ease and it is relatively immune from attack by insect and pathological pests such as have at some time handicapped the development or even menaced the existence of all other species within the plantations.

In the early plantations—particularly those of jack pine, but also those of Scotch pine (*Pinus sylvestris*)—the trees were spaced more closely than they are spaced according to the present practice. The plantations of jack pine set out in 1911 and—to a lesser extent—those set out in 1910, aggregating 150 acres, are conspicuous examples. The number of trees per acre as represented by the density on the experimental plots established in the plantations of 1910, to be described shortly, ranged from 2,288 to 3,144, including a few scattered ponderosa pine trees surviving from earlier, unsuccessful plantations. The lesser number corresponds to a spacing of 4.4 x 4.4 feet. The results of experience in handling private plantations established in Nebraska at a much earlier date, and the manifestly low carrying capacity of the native soil made it apparent within the decade following planting that serious stagnation in growth at an early age would result from this dense stocking.

The Thinning Experiments

In order, therefore, to determine the best spacing from every standpoint, both economic and silvicultural, an experiment was undertaken late in 1920. An area of one-quarter acre within one of the plantations of 1911 was laid out and thinned rather lightly so that 1,616 trees, or 51 per cent of the original stand, remained. The average diameter—at a point 4.5 feet above the ground—of the trees, comprising this stand before thinning, was 1.27 inches. A control plot, on which there were the equivalent of 2,480 trees per acre,—or 53 per cent more than the number left after thinning on the other plot,—was established nearby. The experiment was extended in March, 1923, to include four additional experimental plots of one-eighth acre each. The average diameter of the trees in these unthinned stands was 1.92 inches. The number of trees left after thinning on three of these plots amounted to the equivalent of 1,504, 1,080, and 712 trees per acre, respectively. Considering the number on the unthinned (control) plot — the equivalent of 2,288 trees per acre—as 100 per cent, the stocking on the three other plots as listed above amounts to 60 per cent (a light thinning), 47 per cent (a moderate

thinning), and 30 per cent (a heavy thinning), respectively. The average diameter of the trees left after thinning was 1.98 inches on the control plot and, on the three thinned plots, (in the same order as listed above) 2.10 inches, 2.04 inches, and 2.27 inches, respectively, representing a range of .29 inch between the average diameter of the trees in the unthinned plot and the average diameter of those left on the plot which was most heavily thinned. The average height of the trees left on the control plot was 12.3 feet and the height of those on the thinned plots was 12.4 feet, 11.7 feet, and 12.5 feet, respectively. The scattered ponderosa pine trees left on the plots were measured as to diameter along with the jack pine and the results included in the above figures; sample jack pine trees only were measured to get figures regarding height. Because of the pronounced influence of factors irrelevant to this study on the height growth of ponderosa pine—principally the damage done by the tip moth (*Rhyacionia frustrana bushnelli*),—measurements of such growth would not be representative. The plan for the study calls for the remeasurement of the height of designated trees and of the diameter of all trees at 5-year intervals.

Results of Experiments

The first remeasurement of the trees on all of the plots was made in December, 1926. The results, which were the first to be obtained in a study of thinning practice in planted stands in western United States, indicated that the rate of diameter accretion and, to a much less pronounced degree, the rate of height growth increased in direct ratio with the increased spacing between the trees — in other words, in direct ratio with the decreased density of stocking. These results, however, were not deemed sufficiently conclusive to warrant an unqualified recommendation of the heaviest thinning in c
dinary practice. Two reasons were a
vanced for this. One of these was th
such a thinning would leave very little,
any, margin for possible losses whi
might result in the future from a seve
drought such as the one that occurred
1923 and such as might be expected
occur again at any time. In other wor
it was expected that the minimum wat
supply necessary for survival would
more directly affected by the fortuito
occurrence of favorable precipitation th
by any reduction in the unfavorable i
fluence of competition. The other reas
was the possibility of over-exposing t
soil to the sun and wind and thus n
only endangering such micro-organic li
as might exist within the relatively steri
surface soil, in which very little humus
to be found, but also increasing the oxid
tion of such organic matter as might a
cumulate on the ground. It was al
questioned whether a very open stan
would produce the maximum growt
Four years after thinning the gross vo
ume increment on the lightly thinn
plot amounted to 93 per cent of that
the unthinned plot, while on the mo
erately and heavily thinned plots, it w
only 77 per cent. Accordingly, it w
recommended tentatively that a densi
of about 900 trees per acre, which w
the density on the moderately thinn
plot 15 years after its establishment,
considered standard for subsequent thi
ning operations, which were undertak
on a comprehensive scale beginning
the winter of 1929-30.

The possibility of the moisture supp
being a predominant influence on sur
val and growth was kept in mind at t
time of the second remeasurement of t
experimental plots last September. T
examination provided an 11-year reco
of growth for one set of plots and a
year record for the other group. T

results present some interesting contrasts, of which only a few will be discussed.

The greatest diameter increase has been made in the trees left by the heaviest thinning. The response in rate of growth to increased spacing which was found to exist during the first observation period was maintained and perhaps somewhat more strongly emphasized during the second period. The average annual net[2] increase in diameter per tree, since the thinnings, has been as follows: in the unthinned stands (average for the 1920 and 1923 plots) 0.142 inch; on the lightly thinned plots 0.173 inch (the average of 0.171 inch for the plot thinned in 1930, and 0.175 inch for the plot thinned in 1923); on the plot moderately thinned in 1923, 0.214 inch; on the plot heavily thinned in 1923, 0.245 inch. The average density per acre of the trees on the four classes of plots listed on the preceding page, and in the same order, is now 2,098 (unthinned), 1,480, 896, and 696 trees. The rate of accretion in the heavily thinned stand during the 9-year period was 72 per cent greater than that in the unthinned stands, 45 per cent greater than that in the lightly thinned stands, and 14 per cent greater than that in the moderately thinned stand. There was, however, a pronounced falling off in the rates of diameter accretion on all of the plots since 1926, which is directly attributable to a succession of drought years. The general decline during the second period (1927-1931), based on the average rate of growth during the previous period immediately following thinning (1923-1926), amounted to 41 per cent on the unthinned and the lightly thinned plots of the 1923 group, and 35 per cent in both of the more widely spaced stands, also thinned in 1923.

As to average height growth, the results appear to controvert our usual conception of the effect of thinning in dense stands of coniferous saplings. The rate of height growth per annum on the 1923 plots—listed in the order of decreasing density as above—has been 0.86 foot, 1.16 feet, 1.10 feet, and 1.16 feet. On the plots established in 1920,—one unthinned and one lightly thinned, — the respective growth rates have been 1.03 and 1.13 feet, indicating a striking similarity of performance in the case of the two lightly-thinned stands, at least. All in all, it is evident that the heavily-thinned stand does not suffer in comparison with the lightly-thinned, if anything, shows a slight superiority.

The acceleration in the rate of volume increment following heavy thinning has been more pronounced than had been expected. Where the aggregate stem volume, outside the bark, of trees in the thinned stands was the equivalent of from 38 per cent to 71 per cent only—depending upon the degree of thinning—of the volume of the unthinned stand, corresponding volumes 9 years later ranged from 91 per cent to 102 per cent of the volume at the same time in the unthinned stand, the latter of the two figures relating to the lightly thinned stand. According to the comparison on which the above percentages are based, the heavily thinned stand has made a 58 per cent gain in volume of the unthinned stand, while the moderately thinned and the lightly thinned stands show corresponding gains of 41 per cent and 31 per cent respectively. Within 2 years, it is expected that the volume of the most heavily thinned stand will exceed that of the unthinned stand.

[2]Based on average diameter of living trees at each measurement.

Physiological Considerations Underlying Thinning Practice

Important as volume increment is, and as favorably as it reflects the performance of the most heavily thinned stand, it is by no means the most important consideration in the study of the thinning problem. Among others is the building up of a better cover on the soil, which is an essential part of the process of establishing forest conditions, helps mechanically to reduce evaporation from the soil surface, besides furnishing an invaluable supply of raw material for the production of humus. The presence of humus not only prevents the too rapid seepage of moisture out of the root zone, but it increases the water-holding capacity of the surface soil and thus constitutes a definite factor affecting not only the rate of increment in the trees (quantity) but also the character of the wood produced (quality) as will be shown below. Humus will also supply the acids, the nitrates, and the organic resources which are essential to building up the productivity of the soil. Our knowledge of the micro-organic "constituency of the soil" is, as yet, practically nil, but its relation to the humus problem is so close that in solving the one we shall be in a way to learn about the other. Our past studies of Nebraska sand hills soils within the Nebraska National Forest plantation area have definitely indicated that they are inoculated with fungi which produce mycorrhiza, — a fact which lends encouragement to efforts undertaken to improve the productive possibilities of these soils.

In the leading up to the all-important consideration of moisture economy, an interesting commentary on the question of soil moisture—one of the essential growth conditions affected by thinning—and its relation to wood production is to be found in the results of some tests made at the Forest Products Laboratory at Madison, Wisconsin. In examining san ples of jack pine (also of Scotch pin wood removed in the thinning operatio of 1930 from the stands south of th Bessey Nursery, it was noted that the was a characteristic lack of well-deve oped summer wood, which lends tensi strength to the woody tissue, and that th specific gravity of the material was rel tively low. Since perhaps the most impo tant use for timber grown on the N braska National Forest—at least, for th present—is for fence posts, this deficienc reflected in reduced strength, is of serio consequence. It is attributed to an i sufficient supply of available soil mo ture which restricts the development summer wood by terminating the growi season at a date, soon after the develo ment of the spring wood. This conclusi is based on the results of an experime in irrigation and fertilization carried for 4 years by the Laboratory on o of the sandy areas in the longleaf pi (*Pinus palustris*) type of the Chocta hatchee National Forest in Florida. (T report, *Controlling the Proportion Summerwood in Long Leaf Pine*, by H. Paul and R. O. Marts, appeared the Journal of Forestry, Vol. 29, 784, May, 1931.)

Soil conditions in the sand hills of N braska are similar to those in the regi of Florida where this experiment was co ducted. In both cases the soil, which composed of sand, is very deep and al very porous. The moisture which resul from precipitation promptly percolat to the lower levels, where it is more lik ly to enter into the underground seepa than to be returned to the surface by ca illary action and made available to th trees. Since jack pine is rather shallo rooted, it lacks the capacity of drawi upon the underground supply of moistu and any desiccation of the surface so which occurs most often during the sum mer months, when there is a deficiency

precipitation, is reflected in a deficient development of summer wood. It is possible that low soil fertility is a factor of some importance. However, in view of the fact that the roots of the jack pine are distributed through the upper portion of the soil,—largely within 18 inches of the surface, — it is probable that deficient moisture rather than deficient fertility is the limiting factor.

Conclusions and Practical Application

The evidence presented by the latest growth statistics, when considered in connection with the results of the study of wood structure, throws more light upon the value of early and heavy thinning in jack pine plantations and apparently points the way to a revised conception of the best policy to pursue. The orthodox conception of light and frequent thinnings can hardly be held to apply in this case. A situation is faced which is rather suggestive of the "Wertspflege" of the German foresters Schwappach and Heck, the aim of which is directed toward development of the quality of the individual stem rather than toward the quantity or volume of the stand as in the usual thinning operation. Such a practice does not appear to be out of line with the situation on the Nebraska National Forest, where economic considerations are very favorable for intensive forest management for the following reasons: (1) There is a local demand for practically all materials and products which may be removed in thinning. (2) There is a heavy investment of money by the federal government in the forest growing stock. (3) A plan-wise and orderly silvicultural development is made possible by the fact that the entire operation is artificially accomplished. (4) The compact unit of management favors low operating costs.

The primary consideration which underlies the control of thinning is the conservation of the insufficient supply of moisture and the distribution of it in adequate quantity to each tree among the smallest number of trees which can be grown in such a way as to be consistent with other limiting factors, both silvicultural and economic. This calls for wide spacing, not only to reduce the number of competing individuals, but also to permit as much moisture as possible to fall directly upon the soil. Further, it is quite as important to retard the natural process of percolation in order to hold the moisture for longer periods within the zone of the feeding roots in the upper soil; and this demands the accumulation of the largest possible quantity of organic material on the ground. Hence, the greater the amount of material removed in thinning, the greater the amount available for this purpose. In this connection, the practice of pruning which has been put into effect on a limited scale is definitely valuable; it not only provides another source of supply for organic substance, but it also helps to solve the problem of finding, under heavy thinning, a substitute for the process of natural pruning. Incidentally it may be pointed out that there is a real danger, from the standpoint of future silvicultural development, in permitting the too complete utilization of the products of thinning.

In the end the results of a study such as this must be interpreted in terms of tree growth. In the present case, if the rate of accretion during the first decade after thinning may be accepted as a criterion, a heavy thinning when the trees are from 10 to 12 years of age, resulting in 700 trees per acre, will produce a stand of 6-inch fence-post trees in 27 years — or about 14 years earlier than such trees will be produced, according to the calculated rate of growth, in an unthinned stand—thus reducing by about one-third

the rotation (or harvest) period required for this product.[3] By the end of this hypothetical rotation and at the current rate of periodic annual increment, the volume on the lightly, moderately, and heavily thinned plots may be expected to exceed that of the trees on the unthinned plot by 23 per cent, 19 per cent, and 34 per cent, respectively. This in itself commends thinning to our serious consideration. The further effect of thinning upon the important element of declining acceleration in growth, due to ever-increasing competition by the remaining trees, further enhances the value of such a cultural measure—within reasonable limits—in direct ratio with the degree of the thinning.

Construction Work on National Forests

The program of construction made possible through special relief appropriations of the last Congress benefits many regions embracing national forests. For the eight national forests of the State of Washington, for example, it includes:

15 lookout houses, 4 fire towers, 34 firemen's cabins, 10 ranger station houses, 7 barns, 80 public campgrounds, 16 tool houses, 113 miles of telephone line, 20 miles of pasture fence, 97 stock driveways, 10 range water improvements, and 16 miles of drift fence. A total of 87 miles of secondary or forest roads are to be built, while 32 miles are to be bettered. Trail work will consist of 101 miles of new work and improving 67 miles of existing forest trails.

[3]It may be necessary to plan on a somewhat larger tree in order to provide for the strength required.

HASTENING GERMINATION OF BASSWOOD SEEDS[1]

By J. NELSON SPAETH

Research Assistant Professor of Forestry, Cornell University

The writer makes available a thoroughly tested and practical method of treating basswood seeds to secure prompt and abundant germination. The method is based upon the results of a comprehensive investigation, involving some 35,000 seeds, of the nature of dormancy in seed of *Tilia americana* L.

ANYONE who has attempted to produce basswood seedlings knows that basswood seeds possess a most obstinate type of dormancy. There is abundant evidence of this in the results of germination tests. The germinative capacity of average lots of *Tilia* seeds varies between 70 and 95 per cent. But only in rare and unexplained instances has any germination occurred in the course of ordinary germination tests (90 to 100 days' duration) with either American or European species. Usually little germination takes place in the seed bed even in the second year. Chittenden (1) reports, "Basswood seed is very resistant, some seed planted four years ago still being dormant but viable." Puchner (2), working with small-leaved European linden (*Tilia europaea parvifolia*), secured only 4 per cent germination in four years, although 75 per cent of his seeds were still viable at the end of that period. In seven years he secured 14 per cent total germination from the same lot at the end of which period all ungerminated seeds had decomposed. In other lots he secured only 1 per cent germination in seven years. Our native species appear to be similarly resistant.

The nut-like basswood fruit consists of a woody fruit coat or pericarp, enclosing one or more seeds with cartilaginous testas. The kernel, bounded by a nucellar membrane or tegumen, consists of an embryo completely embedded in endosperm material.

The writer's (3) investigations indicate that an action of the nucellar membrane in reducing the oxygen intake of naked kernels is the important factor in preventing the germination of such kernels when placed under normal germinating conditions. Apparently one of the after-ripening changes in *Tilia* seeds is increased permeability to oxygen whereby the embryo is enabled to germinate. This change takes place readily in moist stratification at refrigeration temperatures, but in some instances it occurs also in air dry storage at room temperature.

While the limitation of oxygen intake seems to be the chief factor preventing germination of naked kernels, impermeability of the testa to moisture is apparently responsible for delaying for several years the germination of intact seeds. An effective method of hastening the germination of basswood seeds involves a procedure which will render the testa water permeable before the seed is subjected to conditions favorable to increased oxygen permeability of the nucellar membrane.

The writer has failed in an attempt to develop a satisfactory procedure for rendering the testa permeable within the pericarp (fruit coat) by treating with hot water or by freezing in liquid air or in a slush of carbon-dioxide snow and ether. Nor has germination been obtained in one year by the exposed burying method of Tozawa (4).

Moisture has little difficulty in penetrat-

[1]Editor's Note: This article is given some priority in publication to permit the trial of the author's method on the 1932 basswood seed crop which is reported to have been heavy. A complete report covering all details of the author's investigation is to be published later.

ing the pericarp walls: the chief means of entrance, however, is a large pore occurring where the peduncle separates from the fruit coat. When placed in water or stratified in a moist medium, free water soon appears about the testa within the pericarp of intact fruits. This free water may remain in contact with the testa for many months or even years of stratification without penetrating it. Although the pericarp does not exclude moisture, it must be gotten rid of before the seed coat can be successfully treated to render it water permeable. Because the pericarp is both hard and tough no mechanical means of removal which does not crush a large portion of the seed has been found. The pericarp may be characterized as a semi-dehiscent husk. It has sutures along which it ultimately splits into crescent-shaped segments, but under natural conditions these sutures are tenacious until the pericarp has been subjected to months of weathering. The writer has found it possible to weaken these sutures and soften the pericarp by partial digestion with nitric acid. The procedure is to place one unit weight of air dry seed in two unit weight of chemically pure acid of 1.42 specific gravity (or roughly 100 grams of seed to each 150 c. c. of acid) and to allow chemical action to proceed until the pericarp is partially digested and the sutures weakened. One-half hour to two hours are required, depending on the nature of the pericarp of a given lot. Fruits may be subjected to much longer periods of digestion without injury to the seed, as nitric acid does not readily attack the testa. Because heat is generated by the reaction, it sometimes becomes necessary to plunge the container into a cold water bath to retard the reaction in order to maintain a temperature sufficiently low to avoid injury to the seed. Fifty degrees centigrade is a suitable working temperature, while a rise to seventy degrees for short periods has not proved harmful. The digesting mass should be stirred intermittently. When the pericarps are sufficiently softened to be separated easily from the seed, the fruit is washed thoroughly and macerated on a screen in running water until all seeds are out of the fruit coats. The mass is then drained and spread out to dry; after drying the extracted seed is easily separated from the pericarp remains by gravity. Extracted seed may be stored in an air dry condition for long periods with little deterioration, as may also whole fruit.

After-ripening in moist storage at a temperature just above freezing requires from 3 to 5 months if the extracted seed has been rendered permeable to moisture at the time of stratification. Therefore, seed should be put into such storage about four months before planting time. The writer has found carbonization with concentrated sulphuric acid to be the most effective means of rendering the testa moisture permeable. Scarification accomplishes the same result but is less uniform in effect. Furthermore, the acid sterilizes the seed and may have a beneficial effect in increasing the acidity of the endosperm and embryo. Periods of from 12 to 30 minutes in concentrated acid (chemically pure, sp. gr., 1.84) depending on the nature of the testa, have been found desirable. Longer periods are likely to be injurious. Seeds should be stirred frequently during acid treatment. Approximately 50 c. c. of acid are required to treat 30 grams (1,000 extracted seed), or 700 cubic centimeters of acid to 1 pound (15,000 extracted seed).

At the end of the treatment seed should be quickly and carefully washed. It is essential that a large volume of water be used in order to dissipate the heat generated. After washing, they should be stratified in a moist sterile medium.

Peat moss, heat sterilized, is one of the most suitable media for stratification because in addition to providing abundant moisture, it gives good aeration. After thorough saturation with sterile water the excess moisture should be squeezed out by hand and the moss mixed with the acid treated seed. Wide-mouthed glass bottles

are excellent containers during the after-ripening period. When stratified at temperatures slightly above freezing *Tilia* seeds after-ripen and start germinating in from 3 to 4 months. If then transferred to temperatures of from 45 to 55°F. germination is more rapid and growth more vigorous. Because the after-ripened seed germinates at relatively low temperatures it should be sown in the seed bed as early in the spring as the bed can be prepared. The seedlings must be protected from frost injury. Prompt and uniform germination in excess of 50 per cent may be anticipated.

Table 1, showing the results of one of thirty basswood germination experiments, is presented to illustrate a number of the facts set forth in preceding paragraphs. The experiment consisted in placing under refrigeration at from 2° to 5°C. for four months, in moist peat moss, lots of seed variously treated. The following points are exemplified: (1) whole fruit does not after-ripen and germinate within the period (lots 1 and 2); (2) seed freed of its pericarp by the nitric acid method does not after-ripen and germinate, therefore the pericarp is not the cause of delay (lot 3); (3) nitric acid extraction does not render the testa permeable (lot 3); (4) scarified seed is more subject to decay than sulphuric acid treated seed (compare lots 4 and 5 with 5 to 9 incl.); (5) when scarified, mechanically extracted seed is more subject to decay than nitric acid extracted seed (compare lots 4 and 5); (6) twelve minutes sulphuric acid treatment of extracted seed effectively conditions it for stratification, thirty minutes acid treatment is not injurious (lots 6 to 9 incl.); (7) seed extracted with nitric acid and treated with sulphuric acid to render the testa permeable has a germinative capacity of from 70 to 90 per cent, and its germination exceeds 48 per cent in four months under the conditions of the above experiment (lots 6 to 9 incl.); (8) thiourea apparently has an effect in stimulating germination and decreasing decay (compare lots 7 and 8). This observation is borne out by other experiments not reported here, but requires further investigation.

Summary

Under natural conditions the germination of basswood seed (which has a normal germinative capacity of from 70 to 95 per cent) is delayed several years. Two factors responsible for delay are the action of the

Table 1

EFFECT OF VARIOUS TREATMENTS ON THE AFTER-RIPENING AND GERMINATION OF TILIA SEEDS IN STRATIFICATION AT 2° TO 5° C[1]

Lot number	Seed used	Treatment before stratification	Condition after four months stratification: Germinated	Sound imbibed	Sound unimbibed	Decayed	Total	Germinated and sound imbibed. Per cent
			Per cent					
1	K'30 whole fruit	None	0	Condition within pericarp not determined			100	?
2	F'31 whole fruit	None	0				100	?
3	K'30 HNO_3 extracted	None	3	4	84	9	100	7
4	K'30 HNO_3 extracted	Scarified	45	19	0	36	100	64
5	F'31 mechanical extracted	Scarified	18	8	8	66	100	26
6	K'30 mechanical extracted	H_2SO_4 20 minutes	58	21	0	21	100	79
7	K'30 HNO_3 extracted	H_2SO_4 12 minutes	49	32	0	19	100	81
8	K'30 HNO_3 extracted	H_2SO_4 12 minutes 4 per cent Thiourea 2 hours	63	25	0	12	100	88
9	F'31 HNO_3 extracted	H_2SO_4 30 minutes	48	28	0	24	100	76

[1]Lots 1 and 2 contained 400 seeds each; all other lots 200 seeds each. This table presents the results of experiment H in a series of 30 basswood germination experiments.

nucellar membrane in reducing oxygen intake and impermeability of the testa to moisture. A practical method of overcoming dormancy involves the following steps: soften the pericarp by partial digestion in concentrated nitric acid; macerate on a screen in running water; dry and separate seed from pericarp remains by gravity; render testas water permeable by treatment with concentrated sulphuric acid; wash and place in refrigeration in a moist sterile medium providing good aeration. Extracted seeds may be stored dry until needed for stratification.

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"Much of the success of a plantation must depend on the person to whom the management is entrusted. If the proprietor has neither time nor inclination to attend personally to his plantations, he ought to choose an experienced person to perform the duty; and, if possible, a person that is settled near the plantation, and one who, from age, etc., is likely to retain the situation for some time; because, it is very obvious, that he who plants, ought, if possible, to nurse up the plantation, since, if the plantation do not thrive, his own credit is at stake."

From *The Forester's Guide*, by Robert Monteath, London, 1836.

THE ROOTS OF A JACK PINE TREE

By E. G. CHEYNEY

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Very little is known of the root habits of forest trees. On theoretical grounds it is often supposed that on dry soils the root system is deep; on moist soils that it is more shallow. In this article the root system of jack pine, growing on dry sandy soil is traced out and shown to be very wide-spreading but not very deep.

MANY INVESTIGATORS have studied the root development of seedling trees and of crops in relation to both soil types and moisture conditions, but no record could be found of any comprehensive study of the roots of mature trees in the United States, probably on account of the tremendous labor involved and the slowness of the process.

So many of the roots encountered in other studies (1, 2) were in the upper foot of soil that it raised the question whether most tree roots would not be found in that same strata. The jack pine was chosen for study because it commonly grows on a very sandy soil and is reputed to be a deep rooted species.

A jack pine ten inches d.b.h. and 45 feet high was chosen. It was growing in a medium dense (0.5) stand of jack pine in which were scattered individuals of aspen, black spruce, balsam and paper birch. These other species were of about the same age as the jack pine, but of smaller size.

A spruce swamp was located about 150 feet to the east of the tree selected for study. A rather steep slope brought the level ground on which the jack pine was growing some fifteen feet above the swamp.

The top foot of soil was a medium fine sand with a few small stones in it. At lower depths the sand gradually became coarser. Six feet below the surface there was a very thin layer, about one-quarter inch, of converted gravel underlain with a thicker layer of fine, white, beach sand, apparent evidence of an old lake bottom.

A hole was first dug on the west side of the tree, great care being taken not to injure the roots which formed such a solid mat that digging was extremely slow and difficult. Once this mat had been penetrated and it was possible to work up to the roots from below, progress was much more rapid. No attempt was made to wash all the fibrous roots out of the soil, but every care was taken not to break them.

As the roots were bared a wooden frame four by six feet, across which cord had been laced so as to divide the enclosed space into four-inch squares, was used to facilitate sketching of the roots. The frame was laid on the mat of roots and stakes driven at the corners to mark the location. The roots were then sketched on cross section paper, the squares of the paper corresponding to the squares of the frame. This method made possible a very accurate mapping of the horizontal roots.

A circle at the end of a root on the map indicates that the root runs down at that point. Each of these circles was numbered and a separate sketch made of each vertical root. This was rather easy because none of the roots sloped down gradually. They turned abrubtly and went down vertically.

It was hoped at first that all of the tree roots within the circle of that jack pine's roots could be mapped, and this was done for about seven or eight feet

on the west and south sides of the tree, but when the length of the jack pine roots was discovered it was evident that there would not be sufficient time to carry through that plan. From that time on, the individual jack pine roots were followed out to the end, and sketches made of only such other roots as crossed them.

Each species was given a different color and the roots kept separate in the sketch in that way.

Practically all of the roots shown in Figure 1 were in the top foot of soil and the great majority of them in the uppe six inches.

The horizontal roots extended 23.3 fee to the north, 16.66 feet to the south, 16.3 feet to the west and 28.00 feet to the eas Strangely enough, nearly all the root went to these four cardinal points. Ther were very few roots to the northeas northwest, southeast or southwest.

Judging from several other jack pine (see Figure 2) the tap root of the on chosen is not typical. Instead of a singl large tap root the tree studied had a num

Fig. 1.—Horizontal distribution of the root system of a jack pine tree 10 inches d.b.h. and 47 feet ta heavy line represents the roots of the tree studied; the light lines show the competing roots of othe

ber of small vertical roots which went down directly under the stump. The deepest one penetrated 5.5 feet; some of the others only 2.5 feet.

These tap roots had a peculiar formation. There were practically no fine, fibrous roots on them. Instead of breaking up into a number of fine roots at the ends, they terminated in short, flattened, fingerlike processes. It is questionable whether they had very much absorptive ability.

In addition to these so-called tap roots, there were a considerable number of lateral roots which turned suddenly at right angles and went down vertically. One lateral root started eight inches below the surface. It so happened that the surface of the ground was slightly undulating. The root undulated with it and remained parallel to the surface for twenty-six feet when it suddenly turned and dropped vertically for five feet to the layer of beach sand mentioned above. There it divided and the two branches ran for three feet in opposite directions on the surface of the beach sand. All of the vertical roots developed from laterals, broke up into fine, fibrous roots at the extremities.

A few of these vertical roots stopped at a depth of two feet but most of them, when they started down, did not stop until they had reached the layer of fine beach sand. None of them penetrated that layer.

There was another peculiarity about those horizontal roots which turned into verticals. Many of them went down open holes in the ground. These holes seemed to be channels left by old vertical roots

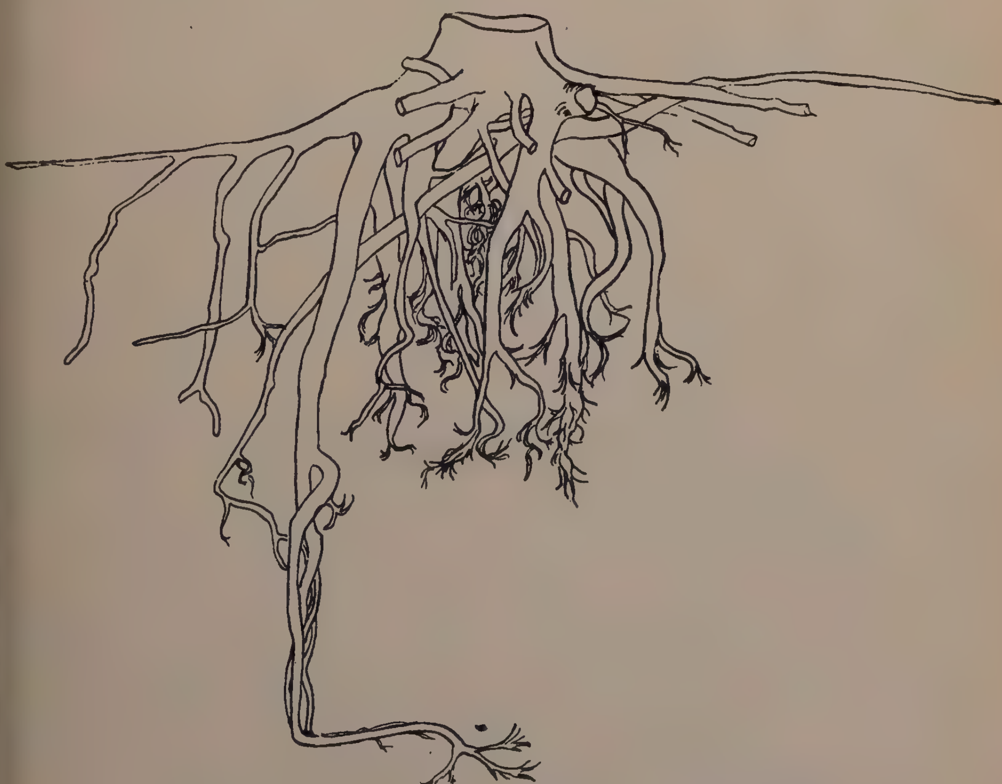

Fig. 2.—Vertical distribution of the roots of the tree studied.

which had rotted out. Possibly more followed this habit than was apparent, for it would have been easily possible for the sand to have run down and filled them up before they were noticed.

This use of old root channels occurred so frequently (2) that it led to a belief that possibly none of these roots, other than the tap roots, would have penetrated beyond their original depth if it had not been for the holes.

The direction of the horizontal roots did not seem to be affected by the presence of other roots save in the case of actual contact. In many cases roots grew directly over to and under other stumps. One root of the tree studied started out in a northerly direction. Ten feet from the mother tree it turned southeast, passed within a foot of another jack pine, under a small birch, almost under another jack pine, and terminated less than three feet from its own stump with a total length of about thirty feet.

Neither does their direction seem to be influenced by the hardness of the soil. The growth of the tap roots and other large roots packs the ground under the stump until it is very hard, almost resembling concrete, and yet many roots grew directly through this hard packed earth without swerving.

One small root, which had apparently struck an obstruction about two feet from the tree, turned directly about, grew back almost parallel to its original course and passed directly under its mother tree.

Laitakari, in his study of Scotch pine roots, mentions many instances of root grafts. A careful watch for them was maintained throughout this work, but only a single instance was found. One root of the mother tree had grown together with the root of another jack pine now dead, some eight feet to the southwest of it.

It would be unwise to draw any sweeping conclusions from the study of this one root system, but several things seem strongly enough indicated to be worthy of mention.

The proportion of the vertical roots in comparison with the horizontal roots is so small that it seems almost certain that the jack pine draws the great bulk of its nutrients and moisture from the upper foot of soil. This is the same stratum from which a vast majority of the shrubs and herbs of this type also draw their nutrients. Moreover, the roots of the aspen, spruce, balsam and birch encountered in this study were practically all in the same stratum.

It is doubtful, in the case of jack pine, whether these trees do very much to enrich the surface soil layers by bringing up mineral salts from the deeper strata by means of their tap roots, or transpire much moisture which might otherwise be lost as ground water.

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SOME DIAMETER DISTRIBUTIONS IN FOREST STANDS OF NORTHWESTERN PENNSYLVANIA

By A. F. HOUGH

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What does the diameter distribution of a forest stand tell the forester? The author has analyzed diameter distributions for some stands containing white pine in Pennsylvania; old white pine stumps from virgin stands logged in the past were also studied. He concludes that an all-species stand graph for mixed stands reveals little as to the age of the stand; that the graph for even-aged white pine resembles the Gauss curve of normal frequency even in stands which are neither fully stocked nor pure; and that stump diameter distributions of virgin stands of white pine strongly suggest evenness of age and catastrophic origin of this species.

DIAMETER DISTRIBUTION in pure, even-aged, fully-stocked stands of several important species has been intensively studied by a number of American foresters. Much less study has been given to the stand tables of mixed, all-aged, or understocked stands. The object of this paper is to discuss diameter distribution of several such stands. Material for the discussion has been drawn from sample areas examined by the Allegheny Station in northwestern Pennsylvania during the field seasons of 1928, 1929, and 1930.

Previous Studies

Baker (1), Bruce (2), Kittredge and Gevorkiantz (5), Meyer (7 and 8), and Gevorkiantz and Zon (4), have successively demonstrated that the stand graphs of pure, even-aged, fully-stocked stands of aspen, southern pines, and white pine tend to conform to the Gauss curve of error, or the law of probabilities.

The stand graph for an all-aged forest is not bell-shaped, but J-shaped. For examples of really smooth curves illustrating the relationship between numbers of trees and diameter in such forests it is probably necessary to borrow from European material. Figure 1-A is from Woolsey (11) and represents a normal selection forest of fir-spruce in France. Figure 1-B diagrammatically illustrates the make-up of this selection forest stand graph. The trees of any given age-class may be sparsely represented on a small area but when grouped for the whole stand will show a dispersion of sizes about an average diameter. Because there are fewer trees in the older classes the curve descends toward the X-axis approaching one arm of a hyperbole. A combination of even-aged stands, skilfully distributed by acreage as a result of long management for sustained yield, could also produce a similar stand graph, but such a combination would hardly ever occur in nature.

The Pennsylvania Stands

The Pennsylvania stands of which the diameter distribution is analyzed in the following pages were in part second growth; in part virgin timber; and in part merely stumps of virgin stands, some logged recently, others years ago. The plots tallied in them were variable in size, and were selected without reference to purity of species or density of stocking.

[1]Maintained by the U. S. Forest Service at Philadelphia, Pennsylvania, in coöperation with the University of Pennsylvania.

Second Growth

The character and fire history of the second-growth plots is shown in Table 1. They were located in Warren, Forest, McKean, and Elk Counties. Age of the white pine on them was obtained from ring counts on stumps or increment cores. The table shows that even-aged stands, chiefly of white pine, were found on Plots 9, 13, and A. Mixed stands with a variety of age classes were found on the two remaining plots. Plot 12 was practically even-aged as to the larger trees, but tolerant subordinate species formed an understory of smaller sizes. Plot 16 had a 65-year old stand opened by fire to the entrance of a 47-year age class.

Stand graphs for these plots, *based on the entire mixture of species*, were found to be exceedingly misleading if used as indicators of age conditions within the stands. For in spite of the diverse mixtures which they represent, these plot curves bear a family resemblance and show a great many more trees in the smaller sizes than in the larger, tending to form a hyperbolic type of curve.

In view of the data presented as to age of the white pine in each plot, it is plain that this curve is *not* that of an all-aged stand; nor is it that of a normal forest (managed: See Figure 1, B), since none of the sample plots is large enough to include a series of age classes. This superficial resemblance to the stand graph of an all-aged forest is due to other causes. Among these is the presence of tolerant, subordinate species, existing as an understory.

Plot 13 is a good example of the way such a stand graph may develop as the result of a combination of species. (Figure 1-C.) The main stand is even-aged white pine which, plotted separately, follows a normal type of distribution curve.

Table 1

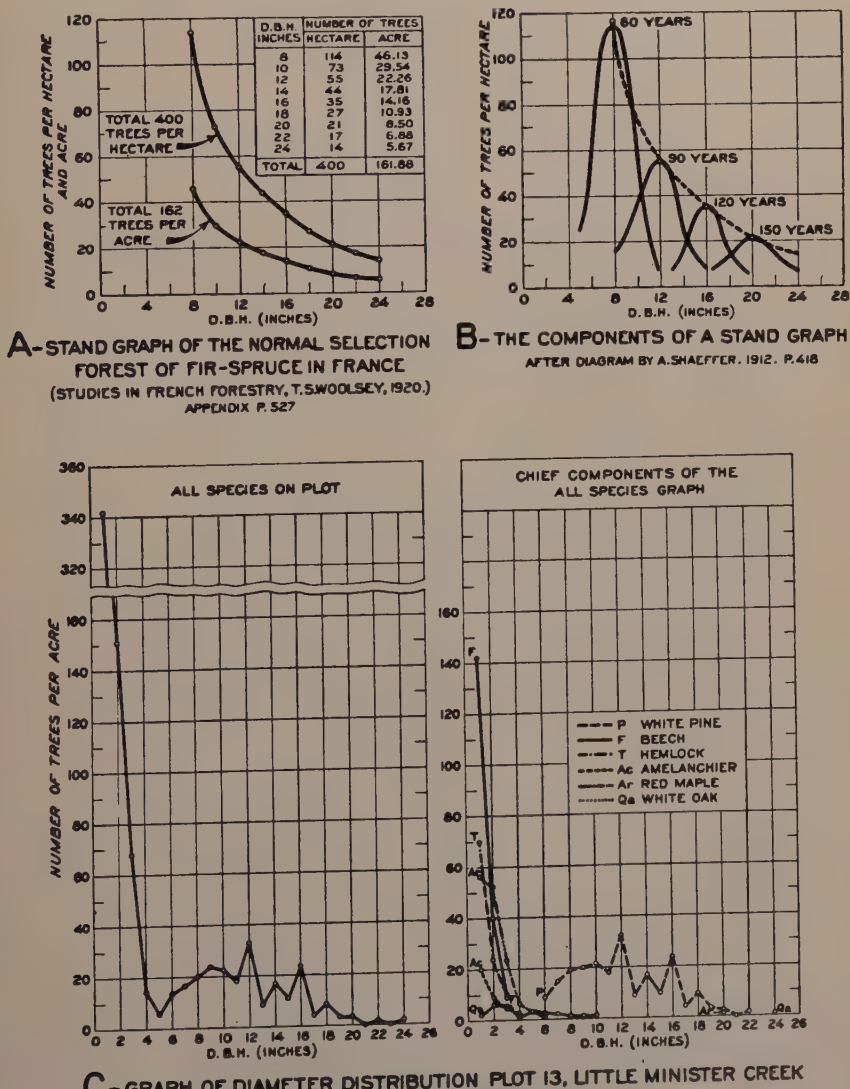
Character and Fire History of Sample Plots

Plot number	Site quality	Age of white pine stand years	Interval since burn years	Trees per acre[1]: All species number	Trees per acre[1]: White pine number	Trees per acre[1]: White pine per cent	Basal area per acre[1]: All species square feet	Basal area per acre[1]: White pine square feet	Basal area per acre[1]: White pine per cent	Diameter breast high[1]: All species inches	Diameter breast high[1]: White pine Average inches	Diameter breast high[1]: White pine Range inches	Number of tree species[2]
9	Medium (old field)	20-30	...[3]	389	348	84	69	63	92	5.5	5.6	4-10[4]	5
12	Good	65 ±	46	238	64	27	180	95	53	10.0	15.8	5-26	10
13	Good	65 ±	46	248	212	85	191	178	93	11.2	11.8	6-22	8
16	Good	65 ±	47	344	27	8	122	44	36	6.9	16.5	5-31	17
A	Good (old field)[5]	70 ±	25	233	190	81	173	162	94	10.9	11.9	4-24	3

[1]Trees 4" d.b.h. and up.
[2]Other than white pine.
[3]No recent burn.
[4]Trees below 4" d.b.h. are present, but are recent reproduction.
[5]Fact of old-field origin authenticated by local resident.

The long arm of the composite curve extending upward to the left is made up of six or more associated hardwood species which form a tolerant understory of relatively small size. Although no age counts were made for hardwoods, this understory is probably all-aged, since reproduction of the understory species is still entering the stand. Obviously, the mere fact that the stand graph of a mixed stand containing some tolerant species falls into a more or less symmetrical hyperbolic curve by no means proves that the whole stand is all-aged. Direct age determinations—ring counts on increment cores or stumps—are necessary to settle such a point.

For all five of the plots the frequency



A-STAND GRAPH OF THE NORMAL SELECTION FOREST OF FIR-SPRUCE IN FRANCE (STUDIES IN FRENCH FORESTRY, T.S.WOOLSEY, 1920.) APPENDIX P. 527

B-THE COMPONENTS OF A STAND GRAPH AFTER DIAGRAM BY A.SHAEFFER. 1912. P.418

C-GRAPH OF DIAMETER DISTRIBUTION PLOT 13, LITTLE MINISTER CREEK BASED ON 728 TREES ON 9/10 ACRE

Fig. 1.—Stand graphs.

polygon obtained by plotting number of white pine alone over diameter, although somewhat skewed, suggests the normal curve of the laws of chance rather than the hyperbolic type of curve. The polygons for these plots are given in Figures 2 and 3. All plots represent even-aged stands (as to white pine), the youngest averaging 26 years and the oldest about 70 years in age.

The diameter distribution of white pine trees on Plot 9 was fitted to a normal curve as shown in Figure 2. Calculation of the standard error of sampling (Mills [9] p. 536) indicates that even for the two most erratic points there are 3 and 1.2 chances out of 100 that such a difference might be expected; applying "the Chi Square" test of goodness of fit, there appear to be 17 chances out of 100 we should secure a fit as bad as or worse than the one actually secured, assuming the underlying distribution to be normal. Weevil damage in this stand was so severe that abnormality in almost any respect would not be surprising.

The diameter measurements on Plot 13 were taken with the Biltmore stick and for this reason a saw-toothed stand graph, showing a constant bias toward the even

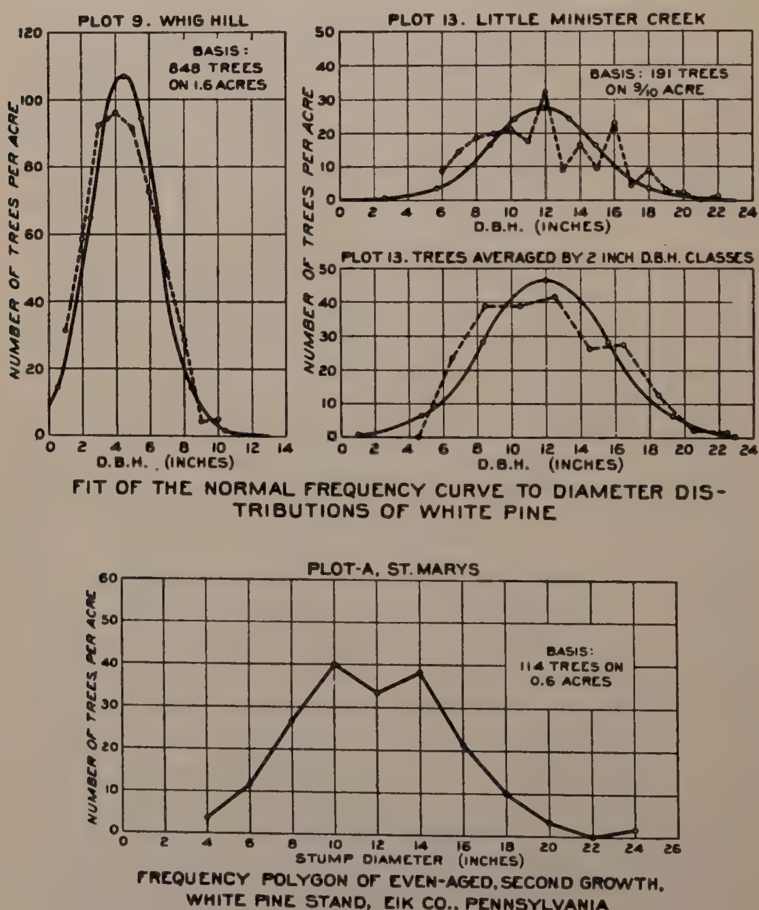


Fig. 2.—Diameter distributions and frequency graphs.

numbered diameter classes, resulted. (Figure 2.) This is a common tendency, and is obviously the result of the human element as noted by Schaeffer (10). Fitting the normal curve to the sample as tallied in the field, and testing this fit, gave very low probabilities for the deviations in the 6, 7, 11, and 13-inch groups. When, however, the trees were grouped in 2-inch classes, as seemed fully justified, a normal curve fitted to the points closely approximated the actual values. By the standard error method of test, the point of greatest deviation was found to have 67 chances out of 100 of recurrence if another such sample were taken. The Chi Square test gave a probability that in 57 out of every 100 trials the fit secured would be as bad as or worse than the actual one secured. Thus we are reasonably certain that the revised data may be described by the normal frequency curve.

Virgin Growth

Hemlock in a virgin stand in northwestern Pennsylvania gives a stand graph of the hyperbolic form. Figure 4-A. This curve represents the major species in a relatively small area, and is based on a 16-acre sample in Hearts Content (6). The lack of certain size classes such as the 12 and 13-inch trees may be due to the inadequacy of the sample, or to past fires which have wiped out reproduction during part of the life of the stand. That this hemlock is all-aged has been determined by a large number of ring counts on stumps adjacent to this stand, and is shown by the curve of d.b.h.—total age, the dotted line in Figure 4-A. (Gates and Nichols [3] found that diameter was approximately correlated with age of both hemlock and sugar

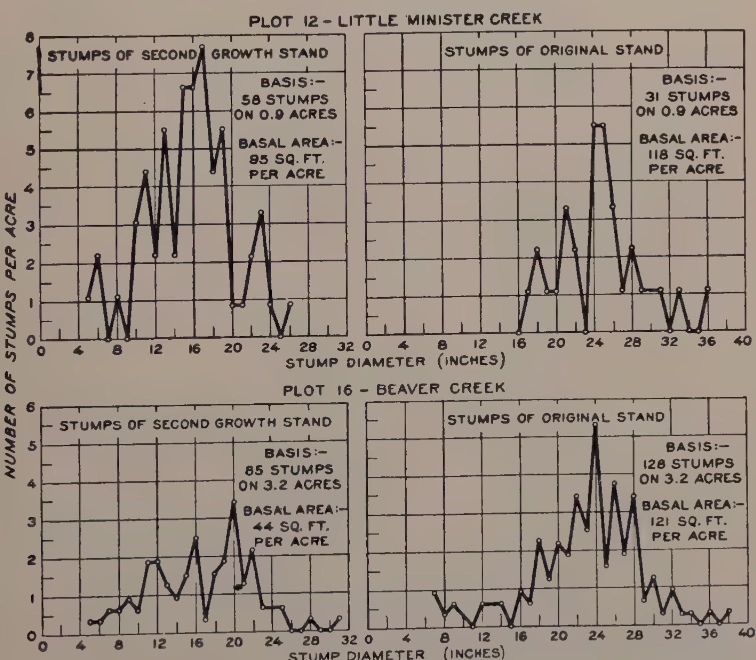


Fig. 3.—Diameter distribution of white pine stumps, Forest county, Pennsylvania, 1928.

maple in a virgin stand of "northern hardwoods" in Michigan.)

White pine in the same stand was, however, essentially even-aged at about 245 years, according to ring counts made in 1928 on pine stumps immediately adjacent. Plotting the tally of white pine on 13.5 strip acres gives a frequency polygon of the form shown in Figure 4-B. (Later stump analyses have revealed that 14 out of 125 trees were between 150 and 200 years old, and therefore constitute a separate age class. The younger trees were localized however, and very few are believed to be included in the 13.5 acre tally.)

A normal curve, superimposed on the stand graph in the same figure, fits the virgin forest data from Hearts Content very well, as shown by both methods of test earlier described. The results of the "standard error of sampling" test appear in Table 2. (To save labor, points at only 4-inch intervals were examined, although the field tally was by 1-inch classes.)

TABLE 2

STANDARD ERROR OF SAMPLING TEST

Midpoint of diameter class (inches)	Percentage fit of points to the normal curve[1]
17	17
21	30
23	38
24	36
26	19
29	22
31	20
37	6
39	34
42	10
45	30
49	17

[1]This per cent, or number of chances in 100, indicates the probability that the particular deviation from the normal curve would occur in another random sample providing the underlying distribution were really normal.

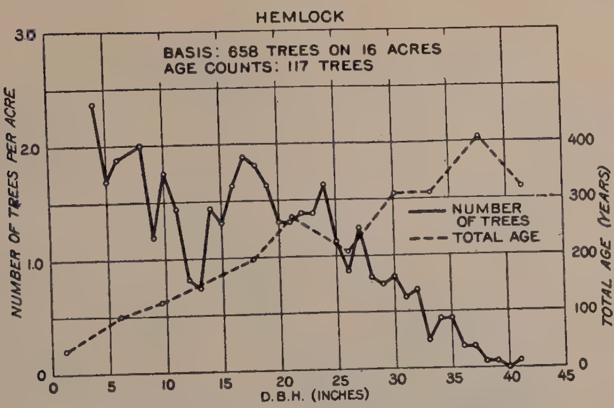
The Chi Square test of goodness of fit for the Hearts Content curve gives a probability that in every 79 out of 100 trials a random sample of such data would give a fit as bad as or worse than the one we secured.

Virgin stands containing white pine are now extremely rare in northern Pennsylvania; those for which authentic age data are available are still more rare. A special study was therefore made[2] of 7 strip acres in Cook Forest, Forest County, in 1930. By basal area, white pine made up 60 per cent of the stand tallied and had more trees in the larger size classes than any other species. Figure 4-C shows its diameter distribution. From stumps and sections cut from windfalls the age of 23 trees has been determined. Where possible the year in which the tree fell was found from the age of the scars on surrounding living trees and this was added to bring the age up to 1930. This method assumes of course that the trees were living when blown down. All the age counts made were between 213 and 261 years, with the greatest number around 240 years. Trees of relatively small diameter, (12 and 13 inches d.b.h.), were fully as old as the larger specimens but had grown under suppression.

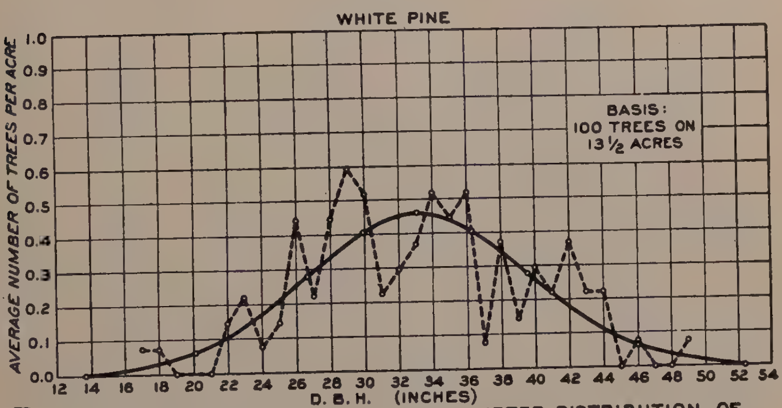
STUMPS OF VIRGIN STANDS

Perhaps the most interesting and significant stand graphs were those obtained in old white pine cuttings, where only the stumps of the virgin pine remain. If evenness of age is associated with a diameter distribution which, even though skewed from the normal curve, approximates normal frequency both in second growth and in virgin timber, may we not reasonably reverse the relationship and conclude that any stand with such a diameter distribution is *per se* even-aged?

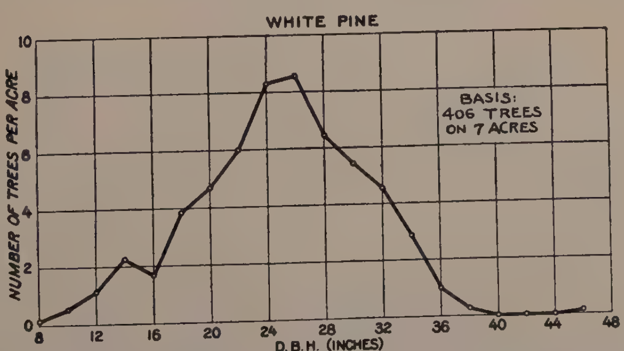
[2]By O. M. Wood, G. L. Schnur, and A. L. McComb.



A - STAND GRAPH OF HEMLOCK IN A VIRGIN FOREST
HEARTS CONTENT, WARREN COUNTY, PENNSYLVANIA
1928

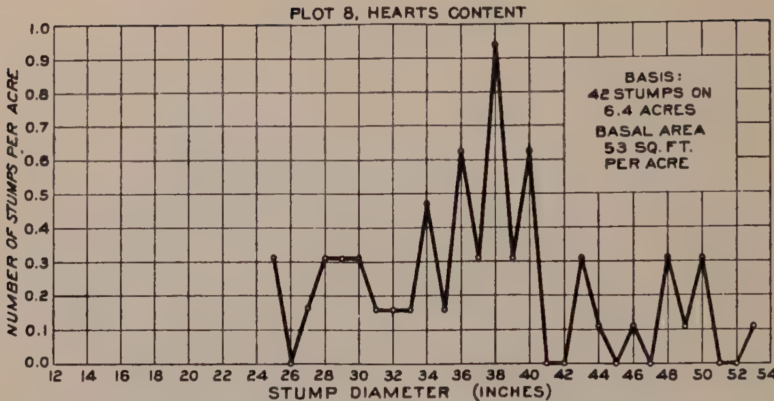


B - FIT OF THE NORMAL CURVE TO THE DIAMETER DISTRIBUTION OF WHITE PINE, HEARTS CONTENT, WARREN COUNTY, PENNSYLVANIA



C - FREQUENCY POLYGON OF WHITE PINE DIAMETER DISTRIBUTION
COOK FOREST, FOREST COUNTY, PENNSYLVANIA

Fig. 4.—Characteristics of old growth stands.



FREQUENCY POLYGON OF RECENTLY CUT STUMPS IN A VIRGIN STAND NEAR HEARTS CONTENT, WARREN COUNTY, PENNSYLVANIA

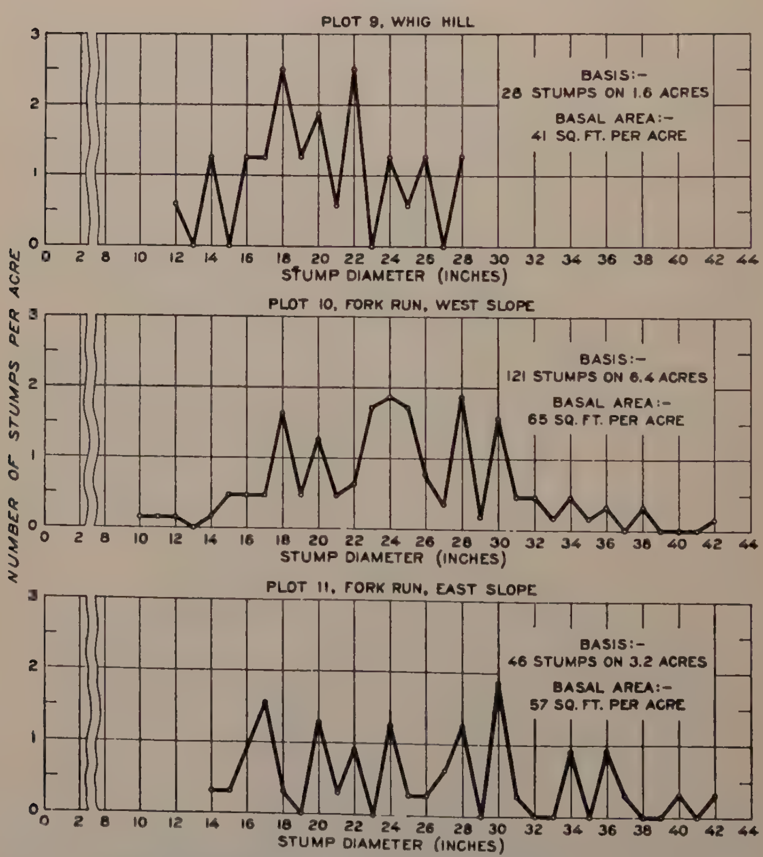


Fig. 5.—Diameter distribution of old white pine stumps in the original stand, Warren and Forest counties, Pennsylvania.

Tallies of all the areas of old white pine stumps—relics of the virgin forest—the Station has so far examined show a diameter distribution approaching that of the normal frequency curve.

A plot of 6.4 acres was laid out about a mile east of Hearts Content in a portion of the same virgin stand, but one which had been clear cut in 1924-25. The tally shows a range of 25 to 53 inches in the stump diameters of the pine, disregarding variation in stump height. On a

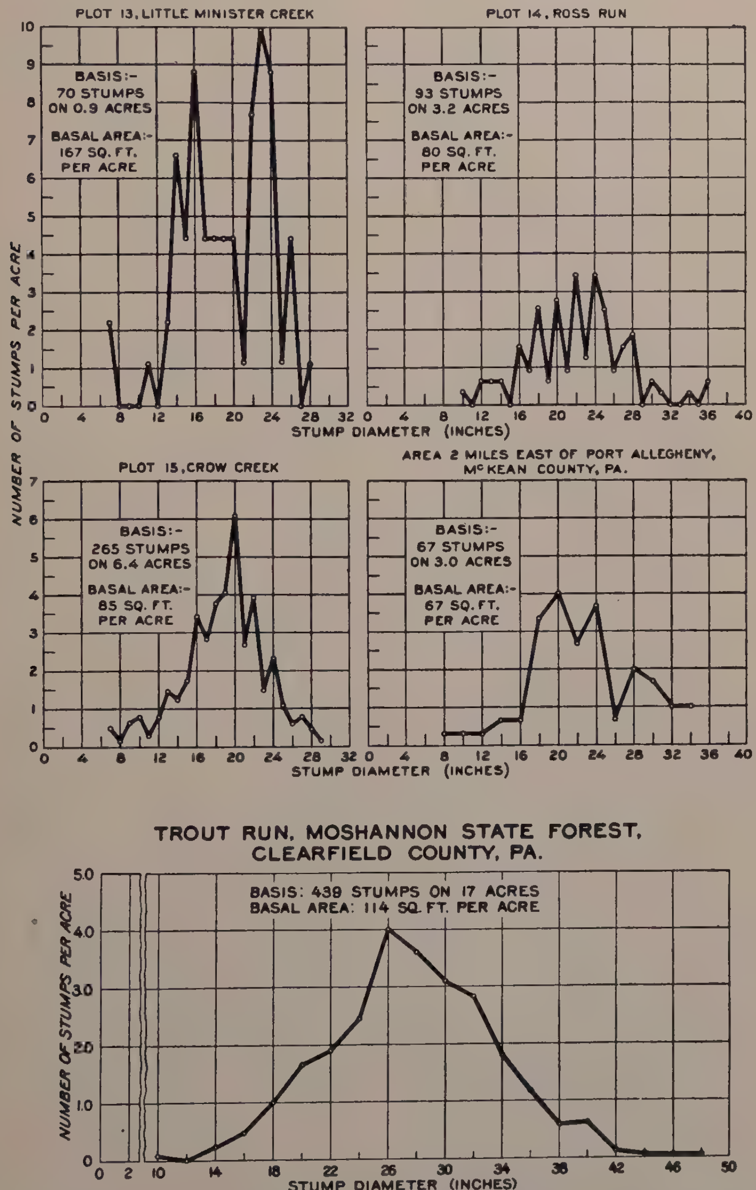


Fig. 6.—The diameter distribution of old white pine stumps in the original stand. Forest, McKean and Clearfield counties, Pennsylvania, 1928-1930.

small scale of ordinates, such as might be used in plotting the stand graph for all species together, the pine curve appears to be extremely flat. It may be shown to approach the normal curve, however, by using a large scale for the vertical ordinates. (Figure 5.)

On Plots 9, 12, 13, and 16, as well as on Plots 10, 11, 14, and 15, not previously referred to because of absence of pine in the second growth, the white pine stumps of the original stand were tallied in addition to recent stumps or trees now standing. The tallies are of course of stumps from which the sapwood has decayed, and show a certain amount of irregularity due to the fact that a rough estimate of the stump diameters was made using a Biltmore stick, with the result that the even diameter classes have been favored above the odd numbered classes. Nevertheless, diameter distribution shows a remarkable trend toward the normal curve of error, as shown in Figures 3, 5, and 6. The absence of any great numbers of trees in the smaller diameter classes is a significant characteristic of these old white pine stands.

The diameter distribution curve of these white pine stumps resembles in every instance the curve which is known to characterize even-aged stands. Although the hyperbolic curve characteristic of all-aged stands may be produced by combining the frequency polygons for several species, each more or less even-aged, or by combining those for several even-aged stands having a good range of average age, it is difficult to see how anything but an essentially even-aged stand could, from a single species and on a small area, produce a bell-shaped stand graph. In 1930 the same crew which examined Cook Forest tallied the white pine stumps on 17 contiguous acres of a 60-year old cutting of virgin timber on the Moshannon State Forest, Clearfield County, Pennsylvania. The stand graph was unmistakably bell-shaped, as shown in Figure 6. The crew also sawed off, or exposed with an axe, cross sections on 9 of the soundest stumps, with diameters from 16 to 36 inches. Their ages, of course without the sapwood, ranged from 180 to 253 years. Although 73 years is too wide an interval to permit of calling this stand even-aged in the ordinary sense of the term, the significant fact is that no reproduction appears to have established itself during the final three-quarters of the life span of the oldest trees.

Conclusions

Direct age counts are necessary to determine age conditions in a mixed stand; stand graphs *based on the entire mixture of species* are misleading when applied for this purpose.

White pine in northwestern Pennsylvania was found to be even-aged in second-growth stands, and essentially even-aged in virgin stands.

The stand graph of even-aged white pine strongly resembles the curve of normal frequency, even in stands which are neither fully stocked nor pure.

Hemlock, in a virgin stand largely composed of this species, gives a stand graph of the all-aged or so called "hyperbolic" form which checks with direct age counts.

Age conditions on areas cut in the past may be inferred from the stand graph obtained from stump tallies. Old white pine stumps from virgin stands logged 60-80 years ago show diameter distributions similar to those observed for second-growth stands, indicating that old growth white pine forests originated in even-aged stands through some catastrophic agency.

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Here, in a new world, with all the defects and stupidities of an antique civilization behind us, it does seem to me that we might have struck out on a new and better road. With all the land on the continent at our service we might have built more spacious and more beautiful cities; we might have achieved some effective method of industrial coöperation; we might have done something to smooth away the infinite injustices that come from the unequal distribution of wealth; we might have conceived a form of land tenure and land ownership that would have been more in conformity with the needs of modern society; we might have thought of a plan which would eventually raise the great mass of men to a better grade of thinking and a higher level of citizenship.

That we did none of these things is one of the tragedies of history.

From *Crowded Years*, by Wm. G. McAdoo, pp. 62-63. 1931.

THE DEVELOPMENT OF SEEDLINGS OF PONDEROSA PINE IN RELATION TO SOIL TYPES

By JOSEPH HOWELL, JR.

U. S. Indian Service, Fort Defiance, Ariz.

Ponderosa pine occurs naturally on a wide variety of soils and consequently the establishment of reproduction varies greatly. The author grew seedlings in eight soil types varying from light pumice to clays, and found that they grew best on lightly combined soils. In a brief note supplementing this article the author reports his work on the influence of soil solution concentration on root development. The more diluted the solution the more extensive the root system must be.

THE EFFECTS of the physical characteristics of the soil (consistency and texture) on the development of seedlings of ponderosa pine (*Pinus ponderosa*, Law.) have been studied at various times and usually under field conditions (all references except 8) but rather misleading conclusions may have been drawn because many factors other than consistency and texture were operating. Of these, the most important factor was moisture, which no doubt greatly affected the resulting data and conclusions. It was, therefore, the object of this experiment to clarify the situation, with moisture not a controlling factor, and an attempt was made to eliminate certain other factors, such as soil reaction and fertility.

Ponderosa pine seedlings were grown under green-house conditions for periods of one-hundred and fifty days in soils of various textures and consistencies. The soils were reduced to a fine condition and then carefully packed in large, galvanized iron containers. Each soil was maintained at a definite, predetermined moisture content by weight which was approximately optimum for the soil concerned. Ordinary distilled water was used to replace the water loss. Deficiencies in fertility were offset by the addition at stated intervals of measured quantities of Shive's "best" culture solution. Seasonal fluctuations in growth were eliminated by growing two sets of plants at different times of the year.

The soils were chosen for their physical characteristics rather than for definite localities, and were divided into four classes; namely, sands, pumice, loams, and clays. A description of the soil material used, follows.

Pumice. This soil material was obtained from southern Oregon and consisted of a buff, fragmental pumice. It was porous and retentive of moisture.

Sands. Coarse Sand. Obtained from the bed of the Sacramento River, Calif. It was a black, coarse sand of mixed origin from the Sierra Nevada and the Coast Ranges.

Medium Sand. Obtained from the sea beach at Monterey, Calif. It was a brown medium sand of mixed origin.

Loams. Sandy Loam. A light brown sandy loam obtained from the Sacramento River, Calif.

Gravelly Loam. This material was gray to black, of sedimentary origin, and represents a re-weathered B horizon. It was obtained from the Berkeley Hills, Calif.

Clay Loam. Gray to black, of the same origin as the gravelly loam.

Clays. Light Clay. This material was taken from the bed of the Sacramento River, Calif. It was a gray to brown clay of a fine, uniform texture, containing approximately 70 per cent silt and clay.

Gravelly Clay. Taken from the old forest nursery at Berkeley, Calif. A dark brown to black, gravelly clay, of a somewhat adobe character.

At the termination of the growth peri- ds, the plants were harvested and the ecessary measurements taken. The re- ılts were subjected to standard statistical nalysis and are summarized in Table 1. 'he probable error differs for the various ıeasures and does not exceed 40.0 per ent of the mean.

These results gave evidence that varia- ion among the plants was large, and they how some significant results in addition.

Haasis (6) found that the clay soils roduced better plants than the cindery oil and loamy soils. This was due, no oubt, to the moisture relationships ather than to the physical characteristic. Little consideration was given to various ther factors, though they may have been nportant.) The lateral roots of the lants growing in the clay soil were not ıore numerous, even though the tap root 'as extensive. The plants found on the inders and loams had a greater number f laterals, well distributed throughout he soil mass. It was evident, from his esults, that the clay soils were better uited to the development of the seedlings, providing that the germinating seeds penetrated the soil crust; also, that those plants existing in the cindery soils were more subject to droughty conditions than those growing in the clayey materials. On the other hand Baker (1, 2) found that a loose soil, light in weight, was the ideal medium for the western yellow pine seedling in the Great Basin Region. A clay soil was not considered to be the best type of material because of the reduction in growth of seedlings.

In the first instance, field specimens, which developed under natural conditions, were studied, while in the second case the plants received sufficient moisture but the soil mass was restricted. Also, insufficient data were presented in both cases, thus preventing conclusive results.

The seedlings in this study did best in the loose soils. The greatest number of laterals were found on the plants growing in the pumice and the sands. The plants growing in the clay soils did not have so many lateral roots nor were the tap roots so extensive as those in the other soils. The total dry weights of the

Table 1

SUMMARY OF MEASUREMENTS

Measurement	Soil number (See note below) 1	2	3	4	5	6	7	8
eight of tops. Centimeters	11.44	10.98	10.90	10.89	9.97	9.07	9.23	8.67
ength of roots. Centimeters	55.4	31.8	35.0	28.8	25.7	37.3	32.0	25.6
iameter of stem. Mms.	2.57	2.56	2.33	2.12	2.16	1.90	2.16	1.74
ry weight of tops. Grams	0.388	0.474	0.529	0.621	0.724	0.485	0.333	0.274
ry weight of roots. Grams	0.469	0.392	0.283	0.171	0.326	0.189	0.213	0.172
otal dry weight. Grams	0.857	0.866	0.812	0.792	1.050	0.674	0.546	0.446
op-root ratio	0.870	1.234	1.872	3,955	2.259	2.621	1.553	1.577
umber of laterals	139.0	97.6	70.4	55.0	52.3	121.7	59.9	49.1
umber of laterals per cm.	2.51	3.06	2.09	1.91	2.03	3.77	1.87	1.92
horls	1.07	1.00	1.23	1.43	0.93	0.46	0.80	0.45
ranches	3.1	2.4	3.2	2.9	2.1	1.1	3.2	1.1
H value of soil	6.82	7.07	6.70	7.01	6.72	7.35	6.24	6.71
oisture per cent in soil	24.48	8.05	14.43	13.19	14.08	6.55	13.66	14.07
ndex numbers	1.00	0.65	0.60	0.46	0.43	0.40	0.39	0.28
atings	1	2	3	4	5	6	7	8

Soil types: 1. Pumice soil; 2. Medium sand; 3. Gravelly loam; 4. Sandy loam; 5. Light clay; Coarse sand; 7. Clay loam; 8. Gravelly clay.

plants were both greatest and least in the two clays. The differences in weight in most cases was small and, therefore, does not show much more than that the conditions were nearly equal in regard to fertility. The relative dry weights of the tops and the roots bring out several noteworthy points. The plants in the pumice soil produced a greater weight of roots than of tops; in fact, the weight of roots produced was much greater than that of any of the other plants. All of the other plants produced the greater weight in tops.

The roots of the plants require energy to penetrate the soil, since the roots, in elongating and expanding, require space and can obtain it only by forcing the soil particles apart. Therefore, energy was expended to overcome the forces of cohesion and adhesion. Mitscherlich (8) found that the amount of energy that a plant must expend to penetrate the soil mass depends upon the physical characteristics of the soil. Therefore, he states, clay soils of a single-grain structure require a greater expenditure of energy than the loams or any soil of a granular structure, other factors being favorable.

From the foregoing statements, the logical conclusion would be, that the pumi soil should have plants with extensi root systems, while the seedlings in th clays should have restricted or reduc root systems. The results tend to substa tiate this in that the mean values for th roots of the plants grown in the pumi soil was 55.4 centimeters, while in th clays the mean of the two sets was 25. centimeters. The plants from the san and loams varied between these limits.

Other measurements were taken whi were of minor interest but tended to sho the degree of development of the see lings. The plants grown in the pumi soils appeared to be superior in all r spects, while the plants grown in the cl soils exhibited many deficiencies. Th color of the poorest plants was not goo as it was a yellowish-green instead of th bright blue-green. This was, no doub due to the inability of the plant to o tain sufficient iron.

The facts give conclusive evidence th the seedlings of ponderosa pine did be in the loosely combined soils. The pun ice soil, which was a friable, granul material, and exceedingly light in weig produced the best plants.

TABLE 2

DISTRIBUTION OF LATERAL ROOTS

NUMBER OF LATERAL ROOTS IN EACH HORIZON

Interval	Soil number (See note below)							
	1	2	3	4	5	6	7	8
0.0– 5.0 cms.	6.0	8.0	5.0	6.1	5.2	8.3	5.2	6.3
5.1–10.0 cms.	15.1	14.0	10.1	12.3	10.7	20.7	11.3	13.2
10.1–15.0 cms.	16.0	20.3	18.0	13.2	19.4	31.8	15.7	13.7
15.1–20.0 cms.	21.1	25.2	12.2	14.1	11.9	25.4	10.1	9.1
20.1–25.0 cms.	16.8	19.0	10.0	9.3	5.1	21.1	9.8	6.8
25.1–30.0 cms.	16.0	11.1	9.1	—	—	11.3	7.8	—
30.1–35.0 cms.	15.1	—	6.0	—	—	3.1	—	—
35.1–40.0 cms.	12.5	—	—	—	—	—	—	—
40.1–45.0 cms.	9.3	—	—	—	—	—	—	—
45.1–50.0 cms.	7.0	—	—	—	—	—	—	—
50.1–55.0 cms.	4.1	—	—	—	—	—	—	—
Totals	139.0	97.6	70.4	55.0	52.3	121.7	59.9	49.1

Soil types: 1. Pumice soil; 2. Medium sand; 3. Gravelly loam; 4. Sandy loam; 5. Light cla 6. Coarse sand; 7. Clay loam; 8. Gravelly clay.

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Twenty-one million acres in the United States have already gone entirely out of cultivation because of destructive erosion. This exceeds the total area of arable land in Japan proper.

EUROPEAN GAME MANAGEMENT AS SUGGESTIVE OF AMERICAN PROCEDURE

By EDWARD C. M. RICHARDS

Consulting and Operating Forester, West Chester, Pa.

Public hunting, as we know it in America, does not exist in Europe. There the hunter may not keep all the game he shoots. Hunting and game management are controlled by the foresters who have learned that silviculture and game production must be coördinated and that neither can be intensive without injury to the other. In asserting that there must be working agreements between timber and game interests and correlation between timber and game as land resources, such as he learned of in Europe, the author has sounded a timely warning. American game is owned and administered by the states and forest considerations and conflicts have not yet been given sufficient thought except where damage has resulted from overpopulation by game.

TO THE American forester visiting European game forests the most outstanding difference, perhaps, is the fact that there is practically no such thing as public hunting. In one or two places, such as in some of the cantons of Switzerland, public hunting by the citizens does exist, but, taken as a whole, our American privilege of public hunting is quite unique from European standards. The recreational value of this privilege enjoyed by Americans stands out very much more forcibly after a visit abroad. In addition, the economic value to the ordinary citizen who likes to hunt is also of no small importance in these days of business depression. By this, I mean that our privilege of not only having the sport of hunting but also of being allowed to keep and use for our own purposes the game that we shoot is something which is not in accord with European practice. As a rule, in Europe, the right to hunt means literally, just the right to the sport of actually doing the hunting, and the successful hunter generally is only permitted to keep for himself certain portions of the game, such as the head in the case of large game, or a very small number of animals or birds in the case of small game; all of the rest of the meat, hides, etc., is retained by the lessor of the hunting privilege and sold to pay expenses for maintaining the game. In many places European foresters were astounded t learn that in Pennsylvania, for instanc any citizen, however poor, is permitte to secure a hunting license for $2.00 ar which will permit him to shoot a consi erable number of small game, anima and birds, together with one bear and on deer during the year, keeping everythin he shoots for himself. These two points— the sport of hunting and the econom value of the game—are privileges th we should treasure as a national right ar favor.

A second point which strikes the Ame ican forester visiting European game fo ests is that the hunting in all of its d tails on any given area is in the contr of the forester in charge. As a rule, th open seasons are established by som federal authority. But in each case th size of the game population maintain on a property, and the size of the annu kill, as well as the selection of the an mals or birds to be killed at any on time, rests absolutely in the hands of th forester. This varies in one or two cas somewhat, and the variations are of suf cient interest to warrant giving them her On one city forest in Switzerland, the a tual determination of the game stand be maintained and the annual kill is le to the lessee of the hunting rights. Ho ever, a check is provided, in that the fo ester in charge, at any time he feels th

the lessee of the game rights is managing the game unwisely is authorized to take up the matter with the city officials. It is understood that his recommendations for the proper conduct of the forest will be accepted as more important than any program laid down according to the wishes of the lessee of the hunting rights. The second variation from the above principle is most interesting at this time to the profession of forestry in America. In Roumania, some years ago, the management of the game rested in the hands of the foresters as is the case in practically all the rest of Europe. It so happened, however, that the foresters took the attitude, not uncommon in the United States, that game and hunting should merely offer an excuse to some men to get away from the restraining influences of their women folks and homes, and to get out in the woods where they can play cards, drink at will, and have a hilarious time, and that any earnest and seriously minded forester should give no attention to hunting, but should think of the forest only in terms of such functions as wood production, and flood control. As a result of this situation the hunters of Roumania concluded that the foresters were unsympathetic toward the interests of the sportsmen. The sportsmen, however, were not only wealthy but also influential politically. They organized, went into politics, and had the entire hunting and game management control taken out of the hands of the foresters and placed under a separate department of the government, so that today the foresters have nothing at all to say about the game, even on their own forests. The Roumanian foresters now realize their serious mistake and are very anxious to do what they can to get back some control over the game in the forests under their charge, not only because of their desire to hunt but because the overpopulation of game may prevent their carrying on the best silvicultural practice.

A third point of interest is that the experience of Europe shows unquestionably that good silvicultural and intensive game management do not mix fully and naturally. If we are going to have intensive silviculture, paying no attention to the game, we are going to have no game. Or, on the other hand, if we are going to have intensive game management on our forests as a first demand on the management of the area, we are not going to have intensive silviculture. In all cases under the observation of the writer, some degree of coördination between the forest management and the game management on a given area is absolutely necessary for the success of either enterprise. This general statement of course varies for the different types of forests and the different kinds of game, but it is important, as far as we are concerned, because it means that we cannot manage our forests without considering the game. Some kind of coördination between the two products of the forest—timber and the game crop—has got to be worked out; it will not work out of itself.

It is well for American foresters to keep in mind the magnitude of the hunting enterprise in this country. In 1931 about 6,900,000 hunting licenses were issued to the sportsmen of the United States and Alaska. For these, upwards of $10,000,000 was paid in to the public treasuries. In addition the license holders spent probably a total of $100,000,000 for their sport. American foresters are faced with the same problem that now troubles the foresters of Roumania, and in addition are faced each year with an army of almost seven million sportsmen who are willing to spend huge sums. Furthermore, these sportsmen are organized on a nation-wide scale with many local chapters, strong political influence and magazines that carry on propaganda in the sportsmen's behalf. It, therefore, appears to be obvious that any attitude of

superiority toward game in connection with forestry on the part of American foresters is very poor strategy. Rather, the above facts definitely point to the necessity for American foresters putting themselves out to understand, coöperate with, and guide the activities of sportsmen. If this is not done, the activities of the sportsmen are almost certain to run away with the activities of the silviculturist.

As an outcome of the study of European game and forest management, several suggestions are worthy of consideration.

First, a study should be inaugurated, perhaps through a committee of the Society of American Foresters, of how the foresters can and should coöperate with the sportsmen. This work should be broad enough to include a study of the relationship of game laws and hunting rights to forests, and also the relationship of foresters to the hunting clubs, sportsmen's societies, etc. In other words, we as foresters ought to make an effort to find out just what the game men are planning to do and how we can fit ourselves into the problem so that forestry itself will not suffer.

A second study, which I believe should be seriously considered by the organized American foresters, should be one of the needs of our forests as related to game. This would include studies of game damage to forests and also the relationship of various kinds of game to various methods of silvicultural practice, and the effect of various types of cuttings, etc. upon various kinds of game.

A third suggestion for study is that of the needs of various kinds of game as related to the practice of silviculture. We should know what ought to be done in given cases to help the forest game and what ought to be done to protect the forests from the game.

The time may be ripe for the appointment of committees in the parent society and in the various sections for taking up the entire subject of forestry and game management, especially the matter of what can and should be done to bring about a closer working agreement between foresters and sportsmen. Possible representation of foresters on the game commissions and sportsmen on some of the foresters' committees might well fall under the consideration of such committees.

A good building is the product of a good architect, a good contractor and good craftsmen using good materials.

IMPRESSIONS OF FORESTRY IN ENGLAND

By BARRINGTON MOORE

The author, formerly editor of the Amercian journal *Ecology* and a well-known forester records here some observations on English forestry he made during a protracted stay in England. He finds increasing interest in forests for their timber as against cover for game. Planting and protection costs strike an American as extremely high yet they do not appear to deter planting. The government encourages private planting through substantial subsidies and favorable taxation.

THE CLIMATE of England is mild and moist, resembling somewhat that of our North Pacific Coast, except that the precipitation is less but more uniformly distributed, and the temperature not as high in summer. A considerable number of tree species can be grown, and those from our Pacific Coast do particularly well, such as Douglas fir and Sitka spruce. Western red cedar (*Thuja plicata*) has recently been introduced and grows rapidly, judging by the examples seen and by what one hears of it. Forest fires are not a problem, except in Scotch pine plantations or on sandy soil; but protection against rabbits is as important as protection against fire with us, and costs more. The soils differ markedly from place to place and there is a surprisingly large variety and range of types.

Public Attitude Towards Forests

For centuries the forests in England have been regarded almost solely as covers for game, in fact a wooded area is still spoken of as "a cover." Furthermore, lands now treeless are called forests, because in the past they were hunting grounds of the king or of a powerful nobleman. Until recently the interest in trees has been mostly arboricultural. It was only in 1931 that the principal association dealing with woodlands, which publishes the *Quarterly Journal of Forestry*, changed its name from the Royal English Arboricultural Society to the Royal English Forestry Society.

The English Forests

The English forests present marked contrasts. A considerable proportion are of oak standards over coppice, the oaks short-boled and limby, and lacking the younger age classes, the coppice mostly hazel for which there is little market. These forests have a very low yield. On the other hand, one may see as well made and thrifty plantations of conifers as can be found anywhere in Europe. In the moist and relatively mild English climate, wherever the soil is favorable, the yield is high and the profits are large. Unfortunately, most owners have not yet come to a realization of the high returns offered by good forestry.[1]

Most of the English forests have been planted, apparently even a good deal of the oak standards over coppice. Natural reproduction, with a few exceptions, is difficult to obtain, and the tendency is all toward artificial regeneration. Under the circumstances this is understandable, even though we need not agree with the arguments that it is cheaper in the end and gives better results because of better control over spacing and selection of species. Silviculture is restricted largely to the development of the stand through thinnings; that part

[1]Hiley, W. E. Improvement of Woodlands. London, Country Life, Ltd. 1931. This non-technical book for the British woodland owner incidentally gives an excellent picture of British forestry and forest conditions.

dealing with cuttings aimed to secure reproduction, which is of so much interest to foresters, is lacking.

Game

Game is an important part of the forest. It constitutes a definite economic asset which may be enjoyed by the owner or sold in the form of shooting rights. There seems to be no difficulty about disposing of the shooting rights where the game has not been too heavily depleted. Both the owners and purchasers of rights have no hesitation about selling their kill and thereby reducing the cost of their sport.

Ownership and Management

While the agricultural land is practically all rented to tenant farmers, the woodlands have remained under the control of the owners. This control is, however, exercised through an agent who must look after all the affairs of the estate and is generally unable to give much attention to the wooded parts. The larger estates employ both a forester and a game-keeper who are, of course, directly under the agent. Where the estate is not large enough for a forester and a gamekeeper one man attends to both; and when that man is primarily a game-keeper the woods suffer. On the smaller estates the agent attends to the woods and the game himself, or on some of the smallest estates the owner may dispense with an agent.

Foresters

The men in charge of actual operations on private forests are not university-trained foresters, probably because the areas are not large enough to carry the expense of such men. Their training has been in the woodsmen's school at the Forest of Dean, or in short courses elsewhere. Owners and estate agents have been able to take forestry courses at Cambridge, Aberdeen, and Wales. Thus the term forester in England has a very different meaning from the term in France, Germany or other European countries; the forester in England in private employment is coördinate with the game-keeper and on about the same plane as the ranger-trained grades in other countries. Foresters with higher training are attached to the Forestry Commission or the universities.

Attitude of the Government

The attitude of the government seems to have been growing more favorable toward forestry even before the war, and has culminated in providing a set of laws which encourage forestry probably more than in any other country in the world. The creation of the Forestry Commission, and its work, are well known. It is interesting to notice that the money has been appropriated and the program carried out practically on schedule in spite of the heavy burden of taxation. This has all been done without the enormous effort on the part of forestry associations which we in America have to put forth to obtain even our inadequate appropriations for fire protection. One wonders how much further advanced forestry would be in the United States if the time and effort spent in extracting appropriations from legislatures could have been devoted to putting forestry into the woods.

Government Measures Favoring Private Forestry

The British Government favors forestry not only in tax concessions but by direct subsidies. A brief summary of these provisions[2] will be of interest, not because they may serve as examples to follow, for they are much more favorable than we would consider advisable in America, but as show

[2]For more complete details see Hiley, W. E. Improvement of Woodlands, pp. 28-41, London: Country Life Ltd., 1931.

ing how far a government will go in trying to foster private forestry.

INCOME TAX DEDUCTIONS

The income from forest land is divided into two parts, known as schedules A and B. Schedule A is used in all cases, but owners wishing to take advantage of the income tax concession are allowed to substitute Schedule D in place of B for all or part of their woodland. The division into two parts is derived from tenant agriculture, where the owner pays an income tax on the rent received, and the farmer pays on income from occupying the land. Since forests are rarely rented (aside from shooting rights) the first part of the tax, Schedule A, is based on an assumed rental value which runs from $0.05 to $10.00 per acre per annum, but averages about $1.08.[3] This is made up of $0.48 for the land and $0.60 for the shooting rights. From the gross annual income thus derived the owner is allowed to deduct one eighth. This eighth represents repairs on farm buildings, but is allowed also for forests.

The second part, Schedule B, is based on the assumption that the income from occupancy equals one-third of the gross annual income under Schedule A. The annual income on a forest of 1,000 acres would be as follows:

Schedule A.		
Gross annual income, 1,000 acres at $1.08 per acre	$1,080	
Deduct one-eighth allowance	135	
	$845	$845
Schedule B.		
One-third of $1,080		$360
Total taxable income		$1,205

Schedule D is the method for calculating income from business, professions, etc., but may be used for forests where accounts of actual profits and losses are kept. It does not pay to use it for merchantable woods since the profits on selling them are large, and back taxes are not deductable. But plantations made since July, 1916, may be classed under Schedule D, and the old woods remain under B. Under D the owner may deduct from his income the rent under Schedule A, less the value of shooting rights, and all costs of planting, cleanings, etc. If Schedule D, instead of B, were applied to the foregoing example, with 50 acres of plantations costing $50 per acre to make (this is the usual figure) and $5 per acre to clean, the income would work out as follows:

Schedule A.		
As above on 1,000 acres		$845
Schedule B.		
On 950 acres, one-third of $1,026		342
Total taxable income		$1,187
Schedule D. (50 *acres*)		
Deduction on Schedule A, rent less shooting, $.48 per acre	$24	
Deduction on planting 50 acres @ $50 per acre, less $10 per acre government subsidy	2,000	
Deduction on cleanings at $5 per acre	250	
Total deductions	2,274	
Excess of deductions over taxable income		$1,087

Thus the owner who planted 50 acres and put them under Schedule D pays on an income of $1,187 and gets a refund on $2,274, or a net refund on $1,087, besides

[3]The gold basis ($4.89 to the pound sterling) is used for converting English to American currency. Prices of materials and labor within the country, so far as they affect forestry operations, are at about the same level as they were before the gold standard was abandoned in August, 1931.

the subsidy of $500 for planting. All the time he may be getting a certain amount of income from his old woods. Yet this extraordinary concession does not seem to stimulate forest planting as one would expect, for Hiley (*loc. cit.* footnote 2) remarks that it is surprising how few owners take advantage of having new plantations assessed under Schedule D, and still more surprising that some of those who use it make the mistake of including all their woodlands instead of only their young plantations under this Schedule. Perhaps one of the reasons may be the lack of adequate cost and return figures, especially on the part of the smaller owners. The tax authorities go very thoroughly into all figures submitted in income tax returns.

Concessions in Death and Succession Duties

In the death duties and succession duties there are also very substantial concessions in regard to forests. The tax on the standing timber is not payable until the timber is cut, and there is no time limit for cutting it. Furthermore, the value of the standing timber is not included in determining the rate of the duty. Since the rate increases with the value of an estate, this means a considerably lower percentage when the estate has substantial areas of woodland. The new owner, if he is wise, has the timber valued at the time of death. Then he pays on the net receipts after deducting all expenses since the time of death, including the cost of replanting. The same concessions apply to succession duty. Thus, if the timber is valued at $50,000 and the estate and succession duties amount to 20 per cent, the total tax is $10,000. If, when the new owner has cut $50,000 worth of timber his costs of selling the timber, management, and replanting have amounted to $8,000 he will have discharged his tax liability for $2,000.

It seems that no provision is made for growth of the timber, so that, if there are rapidly growing plantations, the value will be materially increased by delaying the cutting, without increasing the tax liability.

The effect of these concessions in death and succession duties is to encourage replanting when the timber is cut, and these were deliberately designed for this purpose.

Planting Subsidies

The Forestry Commission grants are a further substantial inducement to planting. The amount depends upon the species, running up to $10.00 per acre for conifers, up to $20.00 for oak and ash, up to $15.00 for beech, maple, and chestnut, and up to $10.00 for other approved hardwoods. They may also grant up to $5.00 per acre for clearing scrub in preparation for planting when the area is not less than 50 acres. The areas are inspected by Forestry Commission officers after planting, and, if approved, 75 per cent of the grant is paid immediately. The remainder is paid four years later if the plantations are considered by the Commission to have been satisfactorily established. Not all owners avail themselves of the government subsidies, though the proportion which does is probably larger than the proportion which takes advantage of the income tax concessions.

Possible Reasons for Decrease in Forest Planting

It is difficult at first to understand why, with economic conditions as favorable as Hiley (*l. c.* footnote 1) shows them to be, and such generous governmental assistance, the area annually planted is less than it was before the war. The Forestry Commission figures show, however, that such is the case. Several reasons are evident and there may be others which have not been noticed.

BREAK UP OF LARGE ESTATES

Perhaps one of the most unfavorable influences on forestry is the breaking up of the large estates, which contained a considerable proportion of the private forests and replanted after cutting. The sources of wealth which permitted the maintenance of large estates below their full productivity are disappearing.[4] Consequently the estates are being sold, and, since nobody can afford to buy and maintain them in their entirety, they are being split up. The woods are then bought by wood merchants who cut them off all at once and do not replant. This not only reduces the total area planted, but has a demoralizing effect on owners who see the future destruction of their forests and the waste of their present efforts. It would be interesting to know how much of the decrease in area planted is due to the splitting up of large estates, and whether, on the remaining private lands, the amount of planting is decreasing or increasing. It would not be surprising to find that it is increasing, since the interest in forestry seems to be growing.

ERRONEOUS BELIEF THAT FORESTRY DOES NOT PAY

The widespread belief that growing timber does not pay deters a great many owners. This belief is not justified, at least on the part of those fortunate enough to possess good forest soil, and to be endowed with the intelligence and energy necessary to success. However, it takes time to change such a deeply rooted feeling, particularly in the face of the age-long attitude towards the woods as mere game covers.

FORM OF MANAGEMENT

Management by an agent, which has already been mentioned, is not conducive to good forestry when the owner exercises little supervision and the woods do not comprise a large proportion of the estate. Some owners take a keen interest in their property, but a good many leave matters pretty much to the agent, while still others hamper an agent desirous of developing the forest because they want the woods left as cover for the foxes or for pheasants. When both the owner and his agent become interested in forestry they must work out the methods themselves without techncial assistance, except such as can be gotten from companies formed to advise forest owners. This advice does not, of course, take the place of constant supervision by a trained forester. Furthermore, in marketing the product, the owner is frequently at the mercy of the local wood merchant. Nevertheless, some owners have built up productive forests and profitable markets; and it is greatly to their credit that they have done so in spite of their handicaps.

POSSIBILITY OF FORMING CO-OPERATIVE GROUPS

A possible solution of the small unit problem would be coöperation between owners; and this has been proposed. Such coöperation would permit the employment of a highly trained forester by a group of owners, with the advantages in production and marketing which such a man could bring. The principal obstacle to this solution seems to be the agent, who has a strong objection to outside interference and hampering restrictions, combined with the usual British distrust of experts. The agents can not be overridden or forced into new ways, and they

[4] Hiley, W. E. England's Great Estates—Are They Doomed? Canadian Forest and Outdoors, Vol. 27, No. 12, pp. 9-11, December, 1931.

are in a very strong position. Many of them are relatives of the owners. Only the oldest son inherits the property, and frequently he employs one of his less fortunate brothers as his agent. If coöperative units are to be successfully built up, great tact and perseverance will be required, and each owner must be left complete freedom. It must be done by employing a forester to whom the owners can turn for advice and assistance, rather than one who will block up and manage a group of forests.

POOR MARKET FOR LOCAL SOFTWOOD LUMBER

Another unfavorable factor in England is the difficulty of marketing softwood lumber on account of the importations from Scandinavian countries and Russia. The wholesaler does not want the small quantities offered, because the supply is so intermittent and the grade so inferior on account of poor manufacturing methods. This is more or less like the situation in much of New England today, where the disappearance of sawmills, following the cutting out of the forests, leaves the small remaining tracts without a market.

When the Forestry Commission plantations come into bearing this situation will to a certain extent correct itself, but not altogether, because the Commission plantations are too small and scattered to support many permanent mills. However, with the development of private sources, it will probably be possible to establish a certain number of units and greatly improve the situation in this respect. At present the market for mine timbers (known as pit props) seems sufficient to care for the entire softwood production on a short rotation, at least where the transportation charges to the mines are not too great.

DIFFICULTY IN THE SELECTION OF SPECIE

Some owners find difficulty in selectin the best species, especially where the forests are on heavy clays and where th distance to the mines reduces the profi on pit props. Oak grows slowly, and as does not have a ready market everywher Larch is the most valuable tree, but th European species is subject to canker an does not grow rapidly, while the Japanes larch, although fast growing in youth, i an unknown quantity after 20 year Owners are uncertain as to the futur value of Douglas fir and Sitka spruc the latter of which is very highly con sidered by some, but has not yet produce marketable stands.

High Planting Costs No Great Deterrent

Planting costs and protection agains rabbits are very high compared wit American costs of planting and fire pro tection. The usual figure is around $40.0 per acre for planting and $10.00 mor per acre for fencing, or a total of $50.0 per acre. The cost of fencing depends o the size and shape of the area, so to certain extent controls planting opera tions, since it would not pay to fence an plant a small tract. Ten acres cost abou $100.00 to fence, and constitute the mini mum size usually undertaken. Howeve these costs are not as much of a deterren as might be thought at first sight. The are due to more care in planting becaus it has been found that the care pays i the long run; and to closer spacing (feet x 3 feet is not uncommon) becaus early thinnings bring in revenue and th more rapid crown closing reduces the ex pense of cleaning the under vegetatio which, in the moist English climate frequently very rank.

Action for Forestry Progress

From the foregoing it may readily be seen that private forestry in England is subject to a good many handicaps. All of them can, no doubt, eventually be overcome. The government is doing its part energetically and generously. The universities are not only training foresters but coöperating with owners. A literature is available which is intelligible to the nontechnical, as for example Hiley's book already cited (footnote 1). The forestry organizations, made up largely of forest owners, hold field meetings in which the actual results of good forestry are shown, and stimulate interest in other ways. In short, the problems are being attacked vigorously from various sides. The objective is to put forestry into the woods and in time it will probably be attained.

Summary

The mild, moist climate of England favors a considerable number of tree species, especially those of our North Pacific Coast.

Forests in England have long been considered primarily as covers for game. This view is still held by the majority of forest owners. On most of the forests the increment is low through neglect by the owners, but there are examples of well grown and highly profitable forests. Natural reproduction is difficult, and most of the forests have been planted. Not a single university-trained forester is employed on a private forest in England, and all the operations are in the hands of men with ranger-grade training, or combined game-keeper foresters, or the owner's agent. The government encourages private forest owners by substantial subsidies for plantations and by extremely favorable provisions in the income tax and death duties.

The acreage planted now is less than before the war. Among the reasons for this are probably the breaking up of the large estates, a widespread but unjustified belief that forestry does not pay, management by agents, the scattered distribution of the woods, combined with obstacles in the way of forming coöperative units, and the difficulty in selecting the species to grow. The high cost ($50.00 per acre) of planting and rabbit fencing is probably not a great deterrent. All agencies concerned, the government, the universities and the forestry organizations, made up largely of forest owners, are doing their part to put forestry into the woods.

MAN'S DESTRUCTIVE USE OF THE EARTH'S RESOURCES

(LO SFRUTTAMENTO RAZIONALE DEL GLOBO)[1]

ADRIANO A. MICHIELI

The white man destroys more than he produces. In the name of civilization he has hastily, unwisely and indifferently exploited soil, water, vegetation, animals, minerals and even his own kind. The author, a distinguished Italian geographer, discusses these acts and suggests the need for intelligent planning, the acceptance of science as a guide, and a better coördination between our advanced knowledge and our use of resources.

THE IRON LAW of necessity has determined the manner in which man must conduct himself in his contact with nature.

As soon as he appeared upon the earth he had to struggle with innumerable obstacles to create for himself even the most modest of living conditions. Since the earth, the air, water and fire appeared to him, from the very beginning, to be the fundamental elements of his existence, he gradually learned to use them to his best advantage.

Ignorant as he was, however, of the true shape of the Earth, with the passage of time he began to understand the mutual relationship of land and water and to reason out the connections between the various elements as known by the ancient philosophers.

Since the dawn of civilization, man has exhibited to the forces of nature a dual behavior, on the one hand cherishing and protecting, and on the other exploiting and destroying.

In every case what spurred him to act was the need for food and shelter, clothing and warmth, that is, the primordial necessities of existence. To obtain nourishment, man with increasing care cultivated fruit bearing plants, and also killed the animals around him with weapons of flint and steel.

Man felled and sawed trees to build his first hut, but in order to have cool shade he planted others. The fate of other plants and animals was determined according to their value as aids to him in his hard existence.

Gradually he advanced by land, discovering new oceans and countries, his dual behavior always manifesting itself in new forms. The march of conquest was seldom restrained by wisdom but was more often governed by his wildness and rashness. The ancient civilization, from Valmichi to Virgil, shows us various examples of love of the soil, but, more common than these collective cases, are single instances dictated in every way by the

[1]A separate from "La Geografia," No. 3-4, p. 128-148, 1926. Translated by Assistant Forest Supervisor, D. E. Romano; revised and edited by T. Lotti and P. O. Rudolf, Lake States Forest Experiment Station.

selfish disregard for the future or by a rare poetic sentiment, the forerunner of the Franciscan idea which is honored even today.

But considering matters in general, the difficult part of the story does not end with destruction. The examples are infinite, but, limiting ourselves to Europe, her people had scarcely taken possession when they cut the forests, reclaimed the salt marshes in times of peace, hunted the animals and destroyed the bear (*Ursus speleus*) and the mammoth; and greatly modified the aspect with axe and pickaxe even before using the plow.

The Pillars of Hercules were not displaced without force, and Alexander and Caesar were able to push their standards further ahead with the aid of the sword.

The Middle Ages was a period of seizure and trespass, and although the Roman element was found among the barbarians through the medium of Christianity, the Benedictine Fathers protected nature with their monasteries, St. Francis writing the *Cantico delle Creature*, and Marco Polo and Fra Odorico di Pordenon, the Zenos and the Vivaldi heralded the age of the Renaissance with their daring voyages.

Following the immortal Columbus, the lovers and students of nature were not the only one to go, but adventurers like Cortex and Pizzaro, who, while conquering new kingdoms under the crown of Spain, destroyed two flourishing civilizations and indirectly brought about disgrace to the whole concourse of explorers. The sixteenth and seventeenth centuries saw Magellan and Tasman upon the world's highways, their accomplishments also greatly adding, powerless to do otherwise, to the horrors of slavery and hunting of the Indians. Were not the negroes merely articles of merchandise? And how did the redskins ever dare to oppose the advance of the whites? Kill. Kill! seemed to be their sole thought—there will always be too many!

Let us not speak then of what happened during these same times in the field of nature. The order of the day seemed to be one of exploitation, which for the most part meant destruction.

Truly, what did the Spaniards do in America? What did most of the Arabian, Portuguese, and Flemish merchants do—and why not?—also the French, German, and English in the African colonies and in Asia. By what criterions did not this same English government of 1700 consider Australia which for more than a century remained a place for deportation? To what purpose did Russia use Siberia up to the year 1880? Alas, in order to advance in conquest and universal knowledge, all these people did nothing but help themselves to inexhaustible treasures in great quantities and at any cost through feverish competition in voyages and expeditions in which the sword overruled the cross and the axe and the plow.

And so for centuries this process continued unceasingly, seeming almost as if the world were without boundaries and its treasures as numerous as the stars in the heavens and the sands

in the sea. Was not man, this small, indomitable, ever-striving creature, able to issue forth from the primitive Asian plateaus and to set forth upon the various highways of the world, and was he not able to emerge from the potamic (river) phase to the Mediterranean and rise after thousands of struggles to conquer the oceans? Were not new lands and seas then opened to his ecstatic gaze, for instance from the top of the first mountain chain, as when Vasco Nunez di Balboa in 1513 from the American Cordillera first viewed the great ocean which Magellan was to cross six years later?

The natural resources of Europe are many, as we have said, but if there were a shortage, for instance, are there not those inexhaustible ones of Africa and Asia? And what might not have happened in the two Americas if the freebooters had succeeded, one after another, in sending galleons laden with gold and spices to Europe?

Onward! Onward! the world is vast; the sea is full of pearls and all belong to those who dare to advance.

This psychology prevailed for a long time among men and nations, and for centuries largely shaped the political actions which are recorded in the histories. A basis of sound reasoning would soon indicate that life is a struggle between organisms, and that if man wishes to exist, he must destroy those plants which are useless to him to protect those which are useful, and destroy the wild animals to protect the domestic animals and cultivated plants. Out of the great number of existing wild plants and animals, many really constitute a hazard to man and a grave obstacle to his advancement upon the earth. It is needless to list them here, but there is no one who does not at once think, for example, of the poisonous plants and parasites, of the entangling lianas, of certain deadly insects like the tsetse fly, of reptiles, of the most ferocious of the carnivora, of the great damage done to the soil, the crops, or springs by certain animals, in themselves harmless, such as the grasshoppers, rabbits, and antelopes, when they occur in excessive numbers.

Not until the nineteenth century, when, after a long series of struggles, man was more or less familiar with all of the Earth and able to form an accurate and organized conception of it, that he began to distinguish definitely those organisms which were useful from those which were harmful and to doubt the inexhaustibility of the world's resources.

As early as the end of the eighteenth century the lovers of nature had developed appealing propaganda in defense of the flowers and trees. Still better, after that date, the many voyages, accomplished by means very different from those of the ancients, on the one hand, and the many scientific discoveries on the other hand, demonstrated that, with the gradual increase in consumption of some of the resources, they were anything but plentiful and that due to unwise use not only had certain plants become extinct, or were on the verge of becoming so, but the same thing had also, or was going to happen, to many animals; and, alas, even several disinherited races were being maltreated

and hated by the whites. The campaign for the liberation of the negroes took place in 1863, and while Harriet Beecher Stowe and Abraham Lincoln fought for this blessed cause, the movement for more humanitarian methods in the advancement of the white race in the world was made public in Europe, either by the work of the philosophers or by the bitter efficacy of the poets and learned men.

II

Although, as I have stated before, this movement to place the problem of the relation between man and nature on its true basis began in the eighteenth century, it was only in the nineteenth century that it succeeded, however.

I say "man", but in truth, I should say "white man", since the colored man, for a great many obvious reasons, never did display destructive deeds equal to those carried on by the ruling race through war and economic exploitation for the development of his commerce.

The colored man, indeed, because of his breeding and mistaken culture, lives upon game and fish, but in his ruinous way of living, either through lack of means or lack of ingenuity, never brought about such destruction as nature can never repair. He, too, captured and killed the animals and cut down the forests, but the rhythm of his axe and traps was not rapid enough to imitate that of the white man who has a more cultivated intelligence and more formidable and highly perfected instruments at his disposal. Also, the black, the yellow and the red man lived in isolated and quite often unfriendly tribes and seldom united their own forces for a war of conquest or an expedition of exploitation. Such attempts are products of civilization, and it was—oh, the irony of it!—in it's name (civilization) that entire forests were burned, wonderful species of birds and fur-bearing animals were destroyed, strata upon strata of minerals almost exhausted, and the tribes of the Algonquins and Maori destroyed or reduced to small numbers.

Gradually as scientific investigation advanced and brought these things to light we understood that we must change our course and put a stop to the erroneous policies of destruction and waste. However, it was only during the past fifty years and in a very general way that the first statistics of natural resources were studied in relation to consumption. They showed that these resources were not inexhaustible and that we should regulate their use more judiciously.

It was thought advisable then (first by the United States and followed soon after by other nations) to enact laws for the protection of natural resources in the broader sense; minerals, plants, and animals; and to establish the first national parks and forests. Those who have the merit of taking the initiative held the same sentiments as the Franciscan Monks, who loved nature for its beauty and its moral significance, and the studious, also, who, through their researches, learned of the irreparable damage that we must call "Charackterisierte Raubwirtschaft" (de-

structive exploitation), raised their voices foretelling the gravest of consequences for the economic situation of the United States. It was not so much due to the lamentations of the former as to the indubitable and precise demonstrations of the latter that even the most indifferent men of affairs began to entertain doubts and become uneasy before committing their customary crimes. Woe then if the law had not intervened to prohibit the continuation of this state of affairs.

The worship of gold made them deaf to the highest sentiments, and the game poachers, dynamite fishers, the relentless otter hunters, and the cruel collectors of humming and song birds would have continued their practices everywhere if there had been no way to punish them. Similarly if the civilized nations had not intervened, the forests that still remained in the different zones of the world would soon have disappeared, swallowed by the paper mills and furniture factories, and the fine balance of climate and water supply would remain upset forever. The making of laws can accomplish much, and woe if it were not so.

But, in face of the irremediable damages which the thoughtless have committed, such action must be encouraged and carried out by continuous propaganda that will produce what may be called the "cosmic knowledge of affairs". Those who possess it immediately see the relations that exist between the sun and a blade of grass, between atmospheric conditions and the harvests, between man's difficult progress and the coöperation, both providential and unconscious, given by nature. And this man, then, does not love life by and for itself but he loves it according to Dante's conception, convinced to the extent of his ability to study and investigate that there is a reason for everything and that everything is a link in the endless chain that ties in every condition with the facts.

To my belief, however, it is not enough to bring the unbelievers, who are in the majority, over to the present great movement for national parks but they should be urged to take part in a campaign of an economic type for the protection of nature in general. The preservation of certain selected areas from the ravages of construction work, or more important from the hotel keepers, for scientific and aesthetic purposes is a fine thing, and it is to be hoped that more of it will be done; but it is not enough for the final solution of the problem. It is urgent to convince mankind (there are already 1850 million people, with no evidence of a decrease in numbers) that his greed will bring about a shortage of at least some of nature's products and make him quite destitute, and that it is the simple, absolute, elementary duty of everyone, as far as possible, to prevent the realization of such a state of affairs.

III

Professor Ernst Friederich of Leipzig University, in his memorandum published in *Petermann's Mitteilungen* and later in his *Trattata di Geografia Economica* (which is unfair to Italians) has already pointed out to us those

facts most typical of that destructive economy called by him "Raubwirtschaft" (destructive exploitation), and Jean Brunhes, the genial and illustrious French geographer, covers the subject fully in Chapter V of his *Geographic Humaine*. It is, therefore, not necessary to repeat these things. It will be sufficient to remember with them that the principal categories into which such thoughtless destruction of nature's gifts falls are the following:

1. *Destruction of mineral products.* By working the surface strata only without any plan of management; and taking only the richest deposits. In most of the mining regions, the owners, rather than be guided by experts, continue to use antiquated and erroneous methods of excavation which soon exhaust the veins and bury enormous quantities of minerals with the refuse.

In other localities the desire for quick profit rather than the systematic extraction of the ore is uppermost, and the mines are exploited in a hasty way; the less valuable ore being thrown on the dump, thus wasting thousands of quintals (100 kilos) of valuable material every year. In this field also haste is the enemy of the public good, and not only in the past but even here and there today, the advice of science has been overlooked and forgotten. It used to be said, and still is said, "but are there not inexhaustible supplies of all minerals?" Indeed not, instead this is one of the many distorted ideas universally circulated by greed. The truth is, according to the most accurate figures, that there is just enough (and not too much) oil, coal, iron, copper, zinc, silver, and gold for a few generations. Geologists have calculated the working life of some of the mineral deposits which, except for the ever-present possibility of the discovery of new beds of coal or copper, is certainly not very great. For instance, in the United States people speak of a 200-years coal supply, a 100-years supply of high grade iron ore, and much less of petroleum. The phosphates of the Andes will be exhausted in a few decades as will also, gradually, the gold mines of California, the silver mines of Mexico and Spain, many of the copper and zinc mines of Europe, and the famous metal mines of Asia Minor.

A serious source of mineral waste lies in the fact that the greatest number of useful minerals are found in the most thickly populated regions, as for example, the layers of coal formed near the Mediterranean zone where the rivers carried most of their sediment, whereas thinly settled regions, like parts of Africa and Asia are poor in minerals.

2. *Waste of soil.* As has been noted the tillable soil is the work of a millennium and the continuous work of nature which employs all of its forces both indigenous and exotic, in its formation. When man took possession of a given region he found the soil in good condition for cultivation, and all that he had to do was to work it and sow the seed since all of the nutrient elements accumulated throughout the centuries were present and gave to the various plants the necessary amounts which they needed in order to flourish.

Now agricultural chemistry on the one side, and the simple observation of facts on the other, clearly demonstrate that man, for the same and customary reasons, takes little heed of such treasures. There are two methods followed in this criminal procedure: the lack of adequate crop-rotations, resulting in the early exhaustion of the soil which cannot maintain its productivity unless aided by fertilizers, and the enormous amount of erosion of the top soil through improper drainage which, if uncorrected will denude the soil in a most serious manner, stripping from its surface the fertile humus which will be carried to the sea.

In this matter the traditional fatalism must be replaced by a sense of responsibility, so that the idea that nature corrects itself does not prevail over the idea that although correction may occur in many cases (but not always), it is a woefully slow phenomenon. Erosion also carries with it so many other sad consequences that it is necessary to oppose it with all the means at our disposal, especially since some of them, when once started, are irreparable.

3. *Waste of water.* Even on this subject the erratic ideas of the past prevailed for the most part. Because of the fact that water comes from the evaporation of the ocean and that it falls upon the earth through periodic precipitation, and that from the earth, where it gathers together in torrents, rivers, and lakes, it is returned to the ocean; it is considered a substance of extreme abundance which will never be lacking, and that therefore, wherever we find it we can squander it in the wildest manner.

Nevertheless, even if the idea of this perpetual water cycle be true, there is nothing more erroneous than that wasteful use does not draw the consequence upon itself. Indeed, it does pass through perpetual evolution from the sea to the sky and from the sky to the earth, but, as meteorology and physiography for some time have clearly shown, the water, depending upon complex physical causes for its precipitation and distribution, is unevenly distributed over the earth's surface. In other words, it is not entirely true, that its quantity is the same today as it has been in the past because—independent of the heated discussion of climatic change—the large scale deforestation carried on in the more populous countries profundly modified the distribution of water, causing it to erode the soil and increasing its evaporation. This uneven distribution alters the run-off which forms rushing abnormal streams and becomes more difficult to control and to utilize.

It is urged, then, even in this matter, to pay as much attention as is possible to the dictates of science, and to use water, which is life, in a more rational manner. To accomplish this nothing would be better than to proceed in the manner which most of the civilized nations have used for some years; that is, to use the water as soon as it issues from the glaciers through the construction of suitable artificial lakes, continuing so to the sea, in order to obtain all the benefits that

water can give, particularly such as power, irrigation, and waterways.

To appreciate its value nothing is more instructive than to consider the situation of arid countries like the Sahara, Arabia, southern Mongolia, the basin regions of the United States, and the greater part of Australia, and the efforts of the inhabitants to obtain at least a small quantity of this indispensible element.

4. *The waste of vegetation.* This was carried on with the greatest indifference through the centuries, and even today, in spite of all the laws extant, it continues in a still more serious manner.

Primitive men felled the trees to make cabins and rafts, and but rarely to clear land or provide fuel wood. Modern men fell them for ties and pulpwood, lumber, poles, and piling, but more foolishly, at least up until fifty years ago, pushed by the eagerness to exploit the virgin soil at any cost, they burned thousands of kilometers of forest to provide clearings for an extensive agriculture. And, in truth, the humus accumulated through centuries united with the potash of the ashes produced superb grain which ripened in a short period to enrich its savage gathers. This method paved the way for poverty twenty or thirty years later, but the pioneers following, did not heed this. So thus, a few acres here and there, but in the aggregate thousands of acres of forest were destroyed, and those who come after, if they wish to gain a living from these lands, must gradually dispose of the burned trunks and dead roots and till deeply to turn over the clay, and since there will not be sufficient rich top soil remaining, they will need to supply phosphates and other fertilizers in order to grow a new crop.

The forests remaining today are the objects of new inroads in the quest for lumber or its by-products, and there is no one who does not know how serious this problem is in the countries of old civilization, which until recently have been almost entirely ignored. For this reason the forested regions of Europe, western Asia, and the United States gradually diminished and today are slowly being converted into government forests. In all the rest of the world, and especially in the tropics, the colonial companies are searching for improved methods for producing cabinet woods, plants containing essential oils, plants for tanning and dyeing, and those of an industrial type such as rubber, gutta percha, raffia, alfa (*Esparto*) grass, etc. The Moloch of modern industry devours more than he produces, since although vast plantations of each of these species, such as the African oil palm (*Elaeis guineensis*) or the rubbertree (*Siphonia elastica*), (*Hevea* sp.) have begun, it is feared that before they are able to supply the world's needs, the wild plants will be almost extinct.

Under such systems certain regions of the earth, at one time covered with a splendid mantle of vegetation, are today almost deserts, since the inhabitants, like the Chinese have done for centuries, did not always follow the dictate of common sense, and preserve the mountains from denudation and

landslides, but instead derided their own fears and yielded to commercial exploitation. And inasmuch as all the phenomena of nature are allied, the ruin of the wet mountain meadows (which normally act as reservoirs) caused the most disastrous floods in the lowland plains, which without regular use became marshes or impoverished land. The streams themselves suffer from this because the water not being held back by the undergrowth sinks into fissures in the ground or rushes towards the sea and cannot be utilized.

5. *The destruction of animals.* In early times wherever man spread, the destruction of ferocious animals was a defensive necessity. Our own Europe at one time had a great number of bear, wolves, lynx, and poisonous reptiles, and it was necessary to exterminate them. In epochal history the lion used to live in Greece and Asia Minor and was destroyed. In India even today 3000 people die annually from the attacks of wild beasts and approximately 20,000 more from snake bites, while certain regions of central Africa are reduced to cemeteries by the work of *Glossina palpalis,* the poisonous fly which produces sleeping sickness in man and beast. With the progress of time the spread of big game hunting and the systematic trapping of birds and fur-bearing animals has changed man's position from one of defense to one of gradual destruction of all wild animals. And if in our country, hunting for sport completed the destruction of game and made the sky "silent of wing and song," in Africa, Asia, America and Australia, the greed for profit has reduced certain magnificent species, at one time very numerous, to a minimum; to name them offhand, the elephant, zebras, antelopes, alligators, ostriches, bison, elk, reindeer, a great number of birds of beautiful colored plumage, many families of fish, almost all of the fur-bearing animals, and the innocent and ingenious beaver. The damages produced by such massacres are not compensated for by the breeding practices which are instituted here and there, and the style, caprice, and frequently preconceived errors as to the ferociousness and noxiousness of animals frequently bring about irreparable damages to nature. To give an idea it is enough to know that the wonderful African heron is almost extinct, the humming birds are found but rarely in the region of the Amazon and in Central America, and that the sea lions and otters of the Aleutians disappeared years ago. In the more populous sections the same thing is happening to the alpine fauna (ermine, squirrels, chamoix, wild goats, wild sheep, etc.) and to the birds beneficial to agriculture. Similarly it will become impossible, or nearly so, to find certain species of fish in the lakes and the more commonly frequented seas.

6. *The destruction of man.* A sixth form of waste or destruction, which is even more serious and cruel, is inflicted upon man himself, and if in the first stages of society it manifested itself in cannibalism, in a more advanced stage it appeared in the slave trade with its attendant horrors, which was inflicted by the white colonists upon the natives of various continents

in the name of a presumptuous law of progress. Even without having read the better known colonial histories, everyone knows, if not otherwise from the old book of Mayne Reid, how the Anglo-Saxons treated the red men, and any book of geography informs one how North America, Argentina, Australia, and northern Africa are completely settled today or almost completely depopulated of their former tribes who are restricted to miserable "reservations", driven like beasts to the most inhospitable sites (examples, the Akka and the Fang), or entirely exterminated with bullets, or worse, with alcohol and tuberculosis. And what has and is happening to the native women? Outside of destruction by cruelty or slavery, they were and are used for pleasure purposes, and even if little is said of it, the victims are legion. All this was occuring throughout the same period of time that we were extensively discussing humanitarianism and people were so greatly affected and moved to pity over the maltreatment of a horse or dog.

We see that progress brings with it a constant accompanyment of contradictions, that is, as Ruskin observed, "the true, sole, principal wealth is that of life" and whoever destroys, offends, or besmirches it, destroys, without perceiving it, the possibilities and rights of possession.

IV

What then, is to be done? Progress has triumphed over numerous obstacles and has brought about radical remedies in many cases but there are still a great many destructive practices to be stopped and many problems to be solved although they are much better understood today than formerly.

As I have indicated before, science has led the way in this movement. But now, notwithstanding the amount which we talk in defense of the forests and waters, the soil and the animals, it is urged that all of the plans which have been conceived for this purpose be coördinated and that societies be formed especially for the defense and protection of "nature" in general and that they endeavor to reunite all the plans of this kind and to demonstrate in the schools, and to the people and the governments the insoluble and intimate connection (of all natural resources). This, because the problem is not composed, as many still think, of many secondary and separate factors, but in its major aspects it is a single, integral problem which will not be solved if all of its various phases are not kept in mind.

Even in this field there have been some occasional notable accomplishments, but the particular government which has occupied itself the most with this question and placed it on its true basis was that of the United States. Previous work has been isolated and indefinite. In one commune the purpose was the preservation of the forests; in another the stream flow. As George P. Marsh observed as far back as 1863 in his classical work, *Man and Nature*, results were not satisfactory because of lack of cohesion. Since the end of 1830, or thereabouts, the campaign for national parks has been going on in the United States,

and due to its brilliant success the government, in 1908, assembled a congress of experts which recommended the institution of special offices for the conservation of natural resources by the various bureaus of the federal government. At the same time, beginning at the close of 1872, when the famous Yellowstone National Park was proclaimed national property, some others like Yosemite, Sequois, Mount Rainier, Crater Lake, Mesa Verde, Glacier, Rocky Mountain, Grand Canyon, etc., were established and rare plants and animals, and the few thousand surviving Indians were included in numerous Reserves.

The various volumes of the Commission of 1908, which it would be impossible to review here, indicate the wisest remedies for each subject. It is useful, however, to bring to mind briefly the following proposals which are embraced in these volumes and various other publications:

1. *To reduce the waste of coal* they recommended paying better heed to the advice of experts, the use of modern mining methods, more efficient burning systems, and the extraction of by-products. *To reduce the waste of minerals* they recommended the more complete utilization of those already extracted, and the application of the best working methods suggested by science in the extraction of others. In many cases the best plan would be to replace the minerals by their substitutes (cement for iron, atmospheric nitrogen for mineral fertilizers, etc.)

2. *To reduce the waste of soil* they recommended greater care in protecting the soil from erosional influences, and paying closer attention to the rotation and fertilization of crops.

3. *To reduce the waste of vegetation* they recommended all the plans already noted for controlling forest fires, ruthless cutting, especially of immature trees, the heedless use of those by-products which take the life of the tree, etc., and in conclusion the introduction of more severe laws limiting the use of the forests.

4. *To reduce the waste of water* they recommended the coördination of all plans for its rational use which have been conceived in various fields, the use of artificial lakes and artesian wells for furnishing drinking water for the great centers of population, or in the introduction of dry farming for the benefit of arid countries so using not only the small intermittent streams but the precipitation which has fallen even in small quantities several months before.

5. *To reduce the destruction of animals* they recommended the establishment of proper reserves, severe penalities for illegal hunting, and more careful study of such animals as are on the road to extinction, or which are interesting from the standpoint of science, and the taking of measures to protect them.

6. Nothing is said concerning the destruction of human beings because there is no one who through the written words does not know what a huge crime this is. The work which has been developed by the Reservations and Ethnographic Institute must therefore ally itself more than ever with that of the missionaries and the

various existing societies for the protection of the colored people.

The recommendations and the program are, as we see, very good, and it is comforting to see that the movement for the protection of nature has risen and spread, during these last thirty years, to most other countries and especially to Argentina, Sweden, Norway, Belgium, Germany, France, Switzerland, Great Britain and all its dominions, and finally even to Italy. It reached us, then, a little late, but during the period of time since it has been started, it has attained noteworthy enough results. We were able not only to establish the Parco Nazionale De Gran Paradisco, Parco dell Abruzzo, Parco Provinciale de Piancenza, and Parco delle Bellezze sotteranee at Adelsberg, but also to incorporate a set of very good rules for the protection of nature into the laws of the land. What is necessary now is the coördination of these regulations with all those which aim at the protection and conservation of nature in general, considering the problem more from the esthetic, scientific, and geographic aspects. Geography, I mean in its broad and integral sense; that is, considering the relationship between earthly phenomena and man and life.

Man, taken in the majority, has for centuries availed himself of the wealth of the Earth as if it were inexhaustible, squandering with mad extravagance all that which appeared plentiful to him. The nineteenth century with its great discoveries, and above all, with the scientific coördination of those discoveries already made, taught man to act more prudently, showing him the methods he must follow to repair the damages already done and to prevent greater ones. It was in this way, that we first began studying the fundamentals of "poleografia" and to start mankind towards a more logical distribution by which means it has been observed that with a proper organization the same human effort can yield a better return, that with the aid of science it will bring about useful and profound changes, that with opportune selections it will better the animal and plant products, that it will be introduced into industry and change its aspects and characteristics by radical perfections in means of communications.

Such admirable work, which still continues, is not, however, sufficient, because as that original writer, O. Effertz, points out, and still more amply demonstrated by Pierre Clerget, what is more necessary to spread the idea of the essential value of the earth's resources is the coördination of production to consumption and distribution of those riches which are exhaustible.

Such a new form of exploitation must associate the technical point of view, which considers the quantity and quality of production and the economic point of view, which is dominated by the idea of the value represented, on the one side by the selling price and cost of production and on the other by the purchasing ability of the consumer. In this way we must reduce the social antagonism resulting from the difference between "productivity" and "capacity for revenue" and suppress the interest which manifests

itself, in order to limit the productive force by artificial means.

It is upon such considerations that O. Effertz recommends the use of a "social budget" to regulate unorganized production and that the state in view of national economy should, in the same manner as individuals do for their own private economy, carry out an inventory of its natural resources, with the intention of organizing a rational method of exploitation. Such inventories now partially under way in Italy will bring about such advantages as stimulating those industries which are basically the most interested in conserving the gifts of nature, to utilize with the greatest care all the disposable forces and products, and to use "white coal" instead of black at the same time benefiting to the greatest extent from all the energy and by-products developed.

As experience has already shown us, a great economy in consumption will be brought about by every future improvement in means of communication and transportation, and in the more extensive application of methods of conservation of products and commodities (the more rational mining methods and use of minerals, the lessening of waste in industry, the fight against plant diseases, the conservation of food supply, the best use of ships, freight cars, refrigerators, etc.) and finally by a better distribution of mankind. This, because all the anomalies of production (under-production and over-production) always have their origin in defective distribution which rebounds in a fatal and inevitable way on the product itself, limiting or determining its depreciation, reducing its amount, or without fail destroying it as the caprice of the present and forgetful of the future.

Another concept which should be spread is that the energy of the earth's resources, if it is an eternal force, is not entirely of its present form and that minerals, soil, water, plants, animals, and human beings in a small degree, if disordered, neglected or killed can reunite and revive.

The old physics axiom "nothing is created and nothing is destroyed" is true, but it is also true that through man's destructive mania many forces have lost, for an indefinite period, their functions of energy and in the perennial transformation of things have assumed other values and meanings.

Woe to us then if we do not always adopt the policies of conservation taken from all the codes of the world and if we are not able to remove from the heart of man that infamous "absolute" right of property which is the cause of many transgressions against nature. In other words the *Jus abutenda* does not exist, because the minerals, the soil, the water, the plants, the beasts, and above all the poor humans in the primitive state do not belong to their occasional proprietors but to human society as a whole and the fact of possession, although it carries some right with it, also involves complex duties of use, according to the laws of natural harmony that some religions have known intuitively for centuries and that science has shown in a clearer light.

The rational exploitation, or better

the rational valuation of the earth's surface should therefore propose as its principal aim the saving of nature from useless destruction, the better adaptation of the people to their environment, and the binding into a more harmonious family of all vital energies with that energy, which by excellence, is man.

Only upon that day when we no longer hear "king of the earth" but instead consider ourselves an integral part of the universe and will see in the rocks, in every product of the soil, and in every living being a part of life itself will civilization be able to intonate its true paean and say, "From this point do I proceed again."

In 1676 the Duke of York, brother of King Charles II of England, made the penalty in Pennsylvania for kindling a fire in the woods and permitting it to escape to cultivated land, the payment of all the damages plus one-half more as a fine. If the guilty person could not pay he was liable to receive "not exceeding twenty stripes,"—in other words, be publicly whipped.

LOS ANGELES COUNTY FORESTRY ACTIVITIES

By GEORGE H. CECIL

Executive Secretary, Conservation Association of Los Angeles County, Calif.

With a budget of $657,000 for the work of its forestry and fire warden department and a personnel of 613, including part-time employees, Los Angeles County is conducting more reforestation and forest protection work than any but a few states. The effort is unique in that it concerns chaparral forests more than tree forests and in that water conservation and flood control are the impelling motives. Of particular interest also is the decision of the County Forester to engage in experimental work to determine the methods of reforestation best suited to the unusually adverse site factors. Mr. Cecil's brief outline of the county's forestry and protection activities is particularly timely in view of the field trips planned for visitors to the annual meeting of the Society of American Foresters in December.

FORESTRY! That is a word to make one recoil in amazement when he considers for the first time its conventional uses in relation to the brush-clad hills of Southern California. True, there are log-size trees in some of the canyons and a few conifers suitable for timber on the higher slopes, but, in the main, the "forest" of Southern California is an undulating expanse of brush named by the Spanish vaqueros "Chaparral."

Less than five per cent, for instance, of the land surface of Los Angeles County, or 94,000 acres, is classed as timber. Brush and chaparral in its related form make up more than 52 per cent. Cultivated land represents approximately 29 per cent.

Notwithstanding its nondescript appearance, however, the chaparral is almost perfectly suited for that purpose which the economics of the region demand—that of watershed cover. Superficially valueless, but inherently priceless, its woody growth clings tenaciously to slopes of shale and detritus. The winter rains falling upon it are stayed from rushing away and wasting into the ocean. It holds fast to the rock and soil in its grasp, preventing erosion. During the prolonged drouth of summer, its metabolism is adapted to a shortage of moisture and not a twig suffers. In fact, for these reasons and others, the chaparral is an admirable growth from a silvicultural standpoint and a satisfactory one for most forest uses; except, that is, for one reason. And that reason is inflammability.

The susceptibility of the Southern California forests to fire loss has created a serious problem that has been solved most effectively in Los Angeles County by the development of a County Forestry Department.

Prior to 1920, there had been no definite forest protection program in the watershed areas outside of the some 700,000 acres embraced within the Angeles National Forest. In fact, except for spasmodic efforts to extinguish the bad brush and grass fires that were a constantly increasing menace to the water supply and property values, one might say that no comprehension of forest needs existed. The combination fire and game warden spent most of his energies in the protection of fish and wild life, and although there had been some minor attempts at reforestation of denuded watersheds, the results were meager and quite experimental in effect.

This order of things was strikingly changed as the decade progressed toward 1930. The department was reorganized in July 1920, giving the forester the office of fire and game warden and allowing him three foremen and fifty-four laborers. Thence forward, the expansion of Los Angeles County forestry activities has been steady, and consistently adapted to

the needs that have arisen from a none-too-well defined problem.

Some brief statistics will best illustrate this decade of growth. For the fiscal year 1920-21, the budget of the Forestry Department was $19,985.66, including $3,904.71 for fire prevention and control. In 1930-31, the Los Angeles County budget alloted $657,195.00 to the forester and fire warden for the conducting of his activities. In the same period of time, the department's personnel increased from 57 to 613, including part-time employees. A diagrammatic outline of the present organization accompanies this article.

State legislation also permits residents of unincorporated communities to organize fire protection districts. This activity is one in which the County Fire and Game Warden Department coöperates, but it is alone concerned with structural fires. It is referred to in the accompanying diagram as the Fire Department Division.

It is also well to note the extensive physical improvements which have been made since 1920. Without mentioning structural properties, the end of the past decade saw the following record of improvements: fire-breaks, 405 miles; trails, 197 miles; motor ways, 21 miles; telephone lines, 221 miles; roadside maintenance, 764 miles.

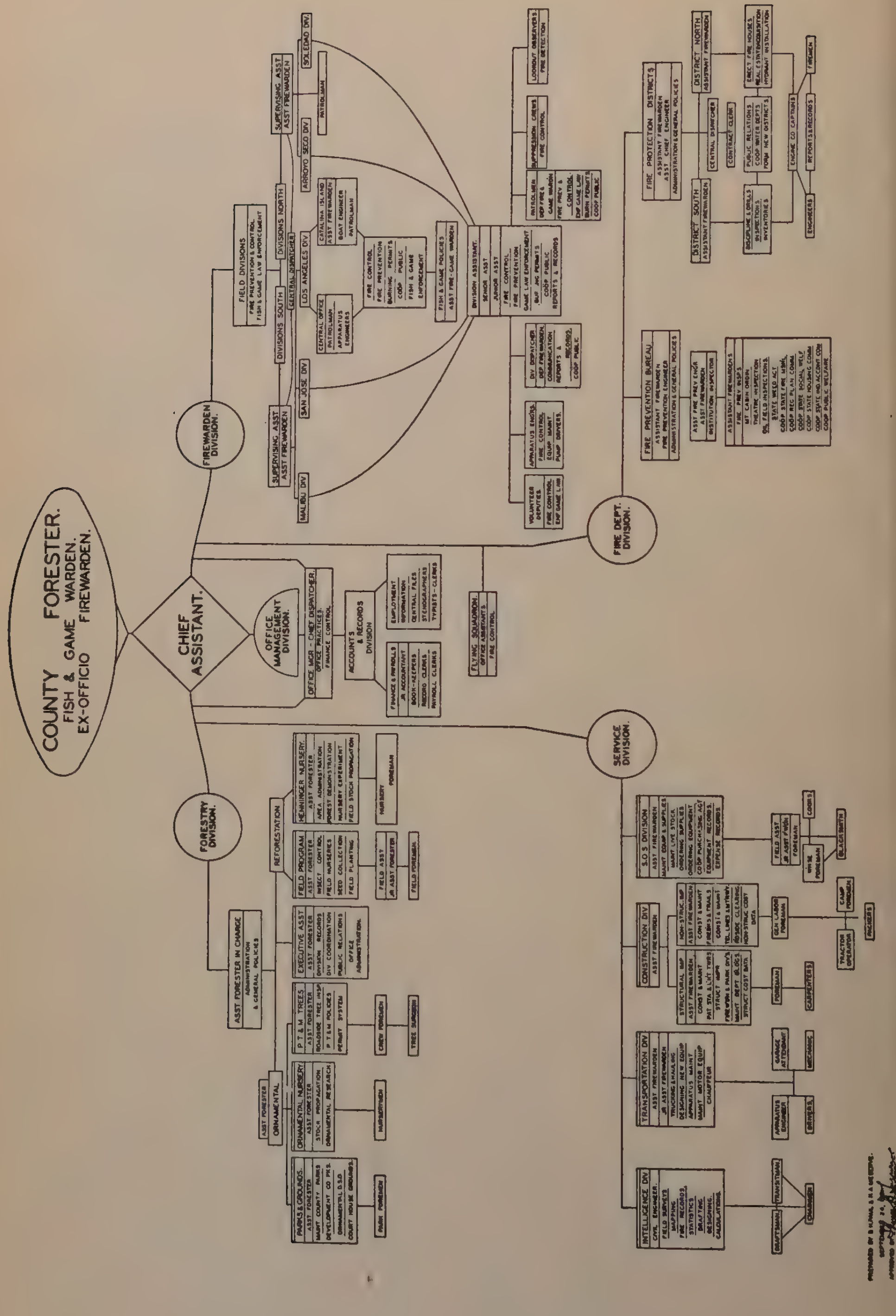
These figures naturally call for some explanation of the area protected and its characteristics. Briefly, the office of the County Forester has been entrusted with the safeguarding and development of the brush cover in the mountain watersheds of Los Angeles County which lie in unincorporated areas outside of the Angeles National Forest. So closely related, however, are the problems and their solutions within and without these political boundaries, that it is often impossible to practically separate them. Considered thus from the standpoint of potential fire risk, there are 1,987 square miles of terrain in Los Angeles County of sufficient elevation to be classed as primary or secondary watershed, almost all of which is covered with woodland brush or timber types. Of this, 860 square miles is under the care of the county forester; 1,021 square miles is within national forest boundaries.

The principal area in the Los Angeles Basin, of 890 square miles, including the watersheds of the Los Angeles and San Gabriel Rivers as well as those of less important streams. Geographically as well as economically this is by far the most important watershed in Southern California. A population of 2,208,492 (April 1930 Census) is largely, although not absolutely, dependent upon it for a water supply. In round numbers, 205,000 acres of irrigated land, with a crop production in 1930 valued at $90,000,000 depend upon it for continued productivity. The 1930 Bureau of Census also reports this area to be fifth in the United States as far as industrial activity in concerned. Obviously, the permanence of water supply is a tremendously important economic matter.

But we have been looking only at one side of the picture. Let us examine a related problem. It is also concerned with water supply, although negatively. I am speaking of flood control.

Within 50 miles of the Pacific seaboard, the mountains of Los Angeles County rise to a maximum height of 10,080 feet. An average precipitation of 36 inches falling upon this mountain area rushes off with great rapidity unless measures are taken to prevent it, endangering and destroying property and life in the lowlands. The last serious flood occurred in 1914 and caused $10,000,000 in damage. Were such a deluge to occur under present development, a loss of $100,000,000 and even of life is probable.

The forestry department has always worked on the assumption that vegetable cover in mountainous areas is essential to the conservation of water derived from rain and snowfall, and has committed it-


COUNTY FORESTER.
FISH & GAME WARDEN.
EX-OFFICIO FIREWARDEN.
CHIEF ASSISTANT.
FORESTRY DIVISION.
FIREWARDEN DIVISION.
OFFICE MANAGEMENT DIVISION.
FIRE DEPT. DIVISION.
SERVICE DIVISION.
FIELD DIVISIONS
DIVISIONS SOUTH
DIVISIONS NORTH
SUPERVISING ASST ASST FIREWARDEN
MALIBU DIV
SAN JOSE DIV
LOS ANGELES DIV
ARROYO SECO DIV
SOLEDAD DIV
CATALINA ISLAND
DIVISION ASSISTANT
FISH & GAME POLICIES
FIRE PROTECTION DISTRICTS
FIRE PREVENTION BUREAU
DISTRICT SOUTH
DISTRICT NORTH
ACCOUNTS & RECORDS DIVISION
FLYING SQUADRON
ASST FORESTER IN CHARGE
REFORESTATION
ORNAMENTAL
HENNINGER NURSERY
FIELD PROGRAM
EXECUTIVE ASST
P.T. & M. TREES
ORNAMENTAL NURSERY
PARKS & GROUNDS
INTELLIGENCE DIV
TRANSPORTATION DIV
CONSTRUCTION DIV
S.O.S. DIVISION

self to a policy of continuing in this position until it has been proved definitely erroneous. No assumption need be made, however, of the effects of forest cover upon erosion and floods. Of growing importance as development in Southern California proceeds, is the need for prevention of floods and erosion, dependent upon a permanent and adequate vegetation for the mountain watersheds.

From our discussion so far, it should be clearly understood that the rule of forests in Los Angeles County is two-fold: water supply and flood control. There is a third—that of recreation which, while it has an important bearing on fire protection, can be disregarded for this paper. It is obvious, then, that the vegetative cover must be maintained. This is largely a matter of fire control. Also, it is desirable that the cover be renewed, which is a matter of reforestation. Because of its major proportions, let us consider the fire problem first.

The significance of the human factor has led to many efforts for accomplishing forest fire prevention. During the decade of 1920 to 1929, a survey shows 94.8 per cent of watershed fires in Los Angeles County to have been caused by human beings and to be, therefore, in the preventable class.

Increased forest use for recreation and the expansion of urban areas are two primal factors leading to fires from debris burning, and a host of other causes, and to tobacco fires and campers' fires.

In the districts becoming urbanized, the problem is a complex one. Whereas, the vegetable cover is a hazard to the urban improvements, the urban improvements are a hazard to the vegetable cover. In the non-inhabited areas the ever-increasing recreational use and the development of new roads naturally tend to increase the fire hazard or at least amplify the possibility of fire origin.

There can be no doubt that the increase in urban growth as the population of the industrial and commercial centers expands should bring about the need for a personnel trained in both structural- and brush-fire fighting. There has already been some growth in this direction. The future will also demand new and radically different equipment to handle a difficult and complex situation.

Aside from the human factor, there are physical difficulties. One of these is distance which is gradually being overcome with good roads and better systems of communication. The topography is also a hindrance to efficient fire control, being extremely rough and precipitious in portions of the county.

Natural atmospheric conditions are also unfavorable to easy fire control, largely because of periods during which the atmospheric humidity is relatively low. Practically every fire of major proportions, within the memory of the writer, has occurred during such times of fire hazard. No manner of anticipating such conditions has yet been devised as the worst fire months are rarely the same during successive years. Some areas within the county present high fire hazards while others are free of them.

In the face of these conditions, it is a tribute to the efforts of the Los Angeles County Forestry Department that the number of forest fires per unit of population has declined favorably during the past decade. The number of fires has not shown any definite change, but since the population has increased enormously during the same time, a favorable situation is shown. In 1921 the ratio of fires per thousand residents was 0.209. This ratio has been reduced in one year as low as 0.068 and in 1929 was 0.106. The following table taken from the Progress Fire Report, Los Angeles County Conservation Association, 1930, contains the complete figures for the decade.

1920	.128	1925	.068
1921	.209	1928	.096
1922	.121	1927	.080

1923	.206	1928	.074
1924	.126	1929	.106

An increase in the denuded areas of Los Angeles County watershed brought to the attention of the Board of Supervisors about 1916 the urgent need for some form of protection against erosion and floods. It was decided that a reforestation program was necessary.

A forest nursery was established in a favorable location for supplying seedlings to the field operations, and various sites for planting were proposed. One of these was a barren hillside north of Los Angeles on the edge of the San Fernando Valley where 3,000 Coulter pine (*Pinus coulteri*) seedlings were set out in March, 1917. Under good care the planting thrived and is now from six to seven feet in height with some specimens as tall as 12 to 15 feet. Luxuriant and thrifty, the planting is an outstanding success and illustrates what forestry may accomplish in southern California with excellent care.

Few of the plantings of this early period were successful, even though there was considerable expansion in later years with increased planting programs. More accurate knowledge of the conditions under which plantings must be made was demanded, for growing conditions in Los Angeles County differ widely with those in other sections where reforestation has been successfully practiced.

In 1930 the county forester decided to change his mode of attack on the reforestation problem. Instead of quantity planting over large areas demanding forest cover, a series of careful experiments are being carried on, the results of which are expected to form the basis for extensive plantings which may be made later.

There are several serious obstacles to be overcome in the reforestation of areas in this vicinity. Perhaps the most important is that for fully eight months of the year there is not sufficient precipitation to maintain tree growth that depends upon surface moisture for its supply. These young trees suffer severely from the effects of drowth. Once they have become well rooted, however, they are able to draw upon the accumulations in the subsoil which are left after the rainy season.

Obviously, one of the first tasks of the forester in such circumstances is to find a suitable species of tree that will withstand dry conditions even during the early years. To this end, many experiments are being tried in which a great variety of forest trees have been planted in trial plots exposed to different conditions of soil, moisture, light, and temperature. The results are being carefully checked to determine the physical factors essential to the successful growth of various tree species in this vicinity.

Rodent damage is another factor with which planting operations have had to cope. Indeed, so serious is this factor that widespread planting appears impossible under present conditions. A great increase in rodent life has followed the wholesale destruction in recent years of wild cats, coyotes, and mountain lions. These predatory mammals largely made their food of the smaller animals, and their removal has allowed the rodents to increase far beyond normal limits. Young trees are a favorite food of these rodents, both below and above ground. Efforts are being made to find some method of protecting the trees until they are old enough to withstand the attacks.

In closing the discussion of this subject, the writer would make it clear that he looks forward less to the establishing of conventional forestry practices in Los Angeles County than to an improvement of brush species and cover. Although there are some areas now almost devoid of cover where tree planting will be necessary, in the long run these should be improved with an efficient brush cover rather than with forest trees. This statement is made, of course, in the light of present knowledge regarding forest influences.

THE REGULATED CUTTING OF CALIFORNIA RED FIR FOR CHRISTMAS TREES

By ARNOLD N. WEBER

U. S. Forest Service, Placerville, Calif.

A new tree species has appeared in the western Christmas tree markets. Because it is cut from national forest lands under stipulated cutting regulations the forester was given a new silvicultural problem. How it was solved is told here.

THE CALIFORNIA Christmas tree market is supplied with three species of trees, the white fir (*Abies concolor* Lindl. & Gord), the California red fir (*Abies magnifica* A. Murr.), the Douglas fir (*Pseudotsuga taxifolia* [Poir] Britt.). The Douglas fir, brought in from the neighboring states of Oregon and Washington, and a few white fir cut in California practically dominated the market until 1927. In that year several enterprising dealers placed the California red fir on sale as the "Silver tip fir." The venture was a success, and the trees brought fancy prices. As a result, other dealers were attracted to the new business in the following year. However, as the trees grow only at the higher elevations and the early winter storms had blocked the roads very few red fir trees were found on the market in 1928.

In 1929 the Eldorado National Forest opened up an area for the cutting of California red fir Christmas trees under certain regulations. The area was located at an elevation of 7,600 feet above sea level and therefore necessitated early cutting. The type of administration necessary to handle this business was borrowed from the Pike National Forest, Colorado, which had been in the Christmas tree business for several years. From the Pike Forest's experience the Eldorado developed a system to meet the local conditions. The sales for 1929 totaled 9,100 trees and yielded a revenue of $1,261. From the volume-of-sales standpoint the year's business was very encouraging. However, the chief value of the business lay in the experience and knowledge gained. The type of administration necessary was determined, the cutting system to be used was developed, and price and selling cost information was gathered.

In 1930, the second year of business, sales amounted to 18,100 trees, with a revenue of $2,296. The sale was administered according to improvements suggested by the sale of 1929. The policy of marking the trees to be cut was instituted and the method of counting was improved upon. As a result of the 1930 sale further improvements were suggested for use in future sales.

The Eldorado Forest entered its third year of business in 1931. All of the previously suggested administration improvements were placed in full operation and functioned successfully. The sales for 1931 totaled 9,100 trees valued at $1,465. This was approximately fifty per cent below the previous year's sale but can be accounted for by the fact that two other national forests in the region entered the business.

The above gives a brief resumè of the Christmas tree business on the Eldorado National Forest. No mention has been made of the problems that were encountered and which took three years of experience to solve. Among these were the questions of proper storage, the cutting system to be used, marking, counting, thinning, prices, and the supply of trees.

Before the Eldorado National Forest could enter the Christmas tree business it

had to determine the length of time that a California red fir would retain its color and foliage. Due to the elevation and danger of closure of the sale area by snow, the cutting of the trees has to be done in October. This means that the trees must be stored for a period of from one to two months. Several storage methods were suggested and used in 1929, some of which proved partially successful while others had to be abandoned. The systems used included, (1) storing in the open under shade and heeling-in the butts, (2) parafining the butts and storing in warehouses, (3) planting in running water, and, (4) storing in cellars. Since none of these systems gave complete satisfaction inquiry was made of cold-storage plants as to the feasibility of utilizing them for tree storage. This plan had such attractive possibilities that practically all of the trees cut in 1930 were placed in cold storage despite the fact that the method was new and untried. Success of the cold storage of the trees was a boon in more ways than one as it not only meant that the red fir could be used but it also showed that cutting could be done before snow closed the forest.

The second problem encountered was the cutting system to be employed. At the inception of the sale the purchaser was allowed to do his own cutting. However, this proved to be poor practice and was abandoned. Instead, the present practice of having the purchaser advance into a special coöperative Christmas-tree-cutting fund, a sum sufficient to cover the cost of cutting, was developed. The Forest Service then hired the men to cut the trees and paid them from this fund. The amount of the deposit was first placed at five cents per tree but is now fixed at fifteen cents per tree. Men trained to do the job of cutting are now available to the Eldorado National Forest and they have a thorough understanding of the cutting regulations.

Another problem which had to be solved was that of marking the trees. In 192 the markers designated the trees to be *left*. Under this system the cutters chose the tree to be cut. This proved unsatisfactory as the type and grade of tree furnished the purchaser was too poor. Consequently in 1930, the policy of marking the trees to be *cut* was instituted. Two men composed the crew, who, after a period of training under the writer marked all of the trees during the 1930 season. Marking precedes the opening of the sale in order to concentrate the cutting of the trees in as short a period as is possible. The physical part of marking is done by closely examining each tree considered satisfactory for a Christmas tree. If it passes inspection a strip of red cambric cloth, one-half inch wide and 18 inches long, is tied to it. The cutters are then assigned to the areas and cut only the designated trees. Marking of the trees to be cut has been the most forward step taken in administration and silviculture. By it the purchaser is guaranteed a salable tree, the number of trees available for cutting is known, and the stand is given proper silvicultural treatment. The average number of trees marked per man day was 300 in 1930; in 1931 this was reduced to approximately 200 trees. The cost of marking approximated two and one-half cents per tree.

Counting of the trees cut is done on the sale area. All of the trees cut are placed in piles, of from 25 to 50 trees each along the roads or at points to which a truck can be driven, and are then graded according to height classes and are counted each day by the counting crew. A tag upon which is shown the number of trees according to height classes, is attached to each pile. A duplicate tag is kept by the counters. Each day's count is recorded in a book from the duplicates and gives a record of the work of each cutting crew. This also acts as a shipping record

cause the tags attached to the piles are collected and signed by the purchaser when the pile is loaded on to a truck. The original tags are then checked against the book and thereby give a check against shipment.

The prices charged for the Christmas trees sold on the Eldorado are based on height classes and are as follows:

1 to 3 feet	$.05
4 to 10 feet	.25
11 to 15 feet	.50
16 to 25 feet	1.00
26 feet plus	5.00

These prices were put into effect in 1931 and are above the prices charged in 1930.

The supply of California red fir is limited to the upper reaches of the Sierra Nevada Mountains at an elevation of from 6,000 feet to 8,500 feet above sea level. The timber stands are usually dense and therefore yield very little opportunity for reproduction to become established. The supply of trees, therefore, is limited as it is only in the openings caused by "blowdowns," along the borders of meadows, and on open ridges where there is sufficient light for growth that reproduction will be found. Also, the fact that red fir reproduction, up to about its 30th year, is extremely slow growing is another natural limit to the supply. Added to these natural factors is the elevation which means early autumn snows, thereby making travel to this region impossible. In normal years the red fir belt is closed by snow between October 15th and November 1st.

The utilization of California red fir for Christmas trees is beneficial to the stand in that the thickets are thereby thinned. The material taken from the stand not only yields a monetary return but also affords better growing conditions for neighboring trees. Moreover, a large portion of this thinned material would succumb to overcrowding if not removed at the present time or in the near future. Furthermore, the stand is improved for the production of better-formed Christmas trees. This will enable the Eldorado to produce a very high quality tree from the areas cut over during the past three years. It is estimated that in from five to ten years a return can be made to these areas for the removal of approximately as many Christmas trees as were taken out originally.

The Eldorado National Forest adopted the Christmas tree tag used on the Pike National Forest. This tag bears a printed message relative to the silvicultural benefits obtained by its removal. The card also carries an appropriate fire protection message. At first, the tags were placed on the trees when cut. However, this procedure has been dropped due to rain and snow blurring their legibility. It is now the practice to ship the tags to the dealers who affix them when the trees are taken out of storage. The value of these tags to the dealers seems to be a moot question. There are some dealers who claim that the tags are of inestimable value to them while there are other dealers who can not see where the tag helps their sales at all.

The Eldorado National Forest has pioneered in the California Region in the cutting and sale of California red fir Christmas trees. In three seasons it has sold 38,800 trees, which have brought in a revenue of $5,022. This business has come to stay and in the future the demands on the national forests for Christmas trees will undoubtedly increase.

A PORTABLE CORDWOOD CHUTE

By HENRY H. TRYON

Director, The Black Rock Forest, Cornwall-on-Hudson, N. Y.

For transporting cordwood in rough steep country a chute made of sixteen-gauge sheet steel was found to be more efficient and economical than teaming.

DURING the winter of 1931-32 the experimental improvement cuttings on the Black Rock Forest were made in a compartment which offered, in large part, an unusually steep and rough logging chance. The hauling out of several hundred cords of hardwood over ground which would obviously be dangerous to men, horses, wagons and sleds was a serious problem.

An excellent main road skirting the base of the rough area could be easily constructed. How best to get the wood down to this road was the question. Wood chutes had formerly been used in this region, but we were averse to sacrificin from our forest capital the considerabl number of straight saplings required fo a pole chute, while one constructed c sawn stock plainly would not stand u for long under the frequent taking dow and reassembling that lay ahead of us.

After a talk with a boilermaker, th portable steel outfit shown in the cut wa evolved. It is made of 16-gauge steel each section is 10.5 feet long, 10 inche wide on the flat bottom, with slightl flared sides turned up 4 inches. Tw staggered nine-sixteenth-inch holes wer punched in both ends of each turned-u

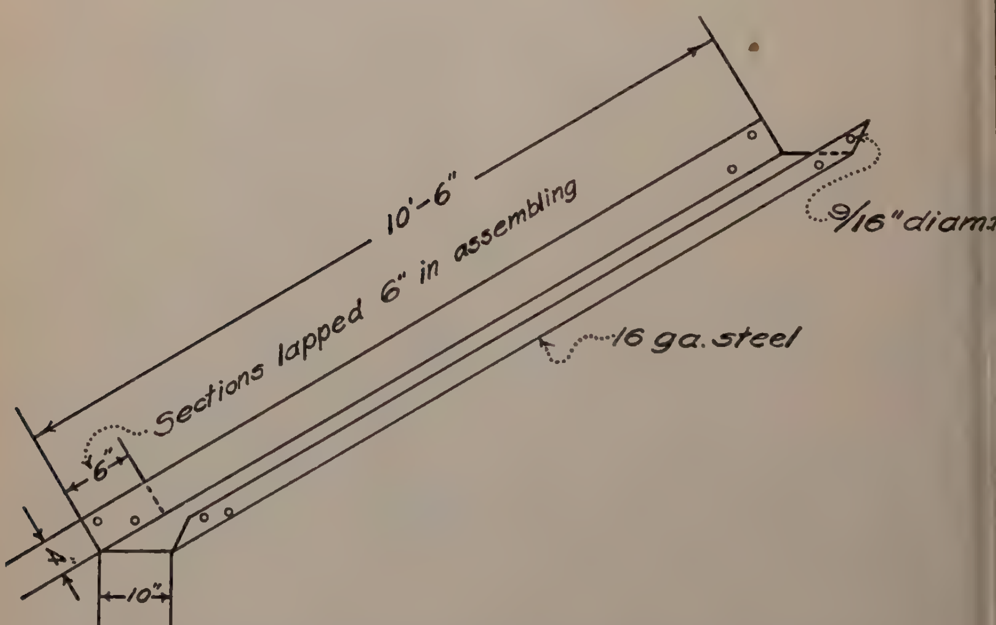


Fig. 1.—One section of the Black Rock Forest portable steel cordwood chute.

side for assembling with one-half-inch slotted panhead brass bolts. Each section weighed about 42 pounds. Outside of its being made of decidedly lighter stock and having neither reinforcing iron or longitudinal taper, a section closely resembles the familiar coal chute.

Foreseeing the probable use of some type of chute, our choppers were required to set their wood ranks as nearly as possible in straight lines through the center of their strips so that each setting of the chute might tap the greatest possible number of ranks. The actual operation proved to be surprisingly simple and successful.

Laying the chute is curiously similar to railroad location. It should run on tangents if possible. Where curves are unavoidable, they cannot be sharp and the outer side of the chute must be perceptibly elevated. If these precautions be omitted, the wood will jump. Where the slope is bland the chute may be laid directly on the ground. Where the profile is sharply broken we build small cribs, using heavy, half-round cordwood sticks, to get the smoothest and most gradual transition possible between vertical curves. Otherwise, wood will leave the chute in surprising fashion. The chute must be anchored in place to prevent its slipping downhill. Several 12-foot pieces of one-half-inch rope, each with an S-hook at one end are used. These are useful in various ways, but chiefly in making the chute fast by slipping the S-hook through one of the punched nine-sixteenth-inch holes and taking a turn around a tree or stump. Hay-wire has been tried, but rope is far better. Such supporting cribs as are needed rarely require spiking together. A few lashings with the one-half-inch rope will usually serve.

A four-man crew proved to be most efficient. Even in pretty rough ground one man can carry two assembled sections. Such a crew could knock down, move, lay, crib up, make fast and have ready for use 650 feet of chute in about 90 minutes. After laying, the speed with which the wood is delivered to the main road is directly proportional to the rate at which it is fed into the receiving end.

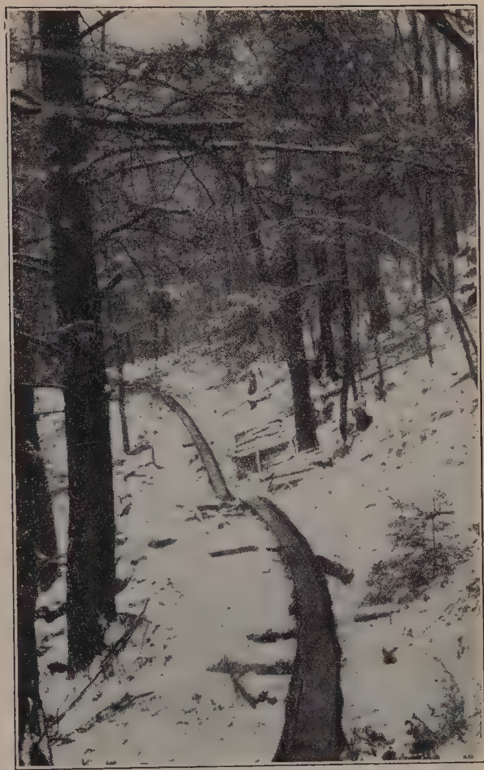


Fig. 2.—The chute in operation along an old woods road. In this case the chute eliminated rebuilding the road and, moreover, reduced the team labor merely to drawing away the heap of wood collected at the discharge end.

In snappy weather wood will usually run well. In hot, dry weather it is occasionally necessary to wet the steel. The familiar 5-gallon knapsack pump is useful for this purpose. A little water sprayed into the chute at the receiving point and allowed to trickle down will help greatly. Do not use too much water at any one time. Frequent, light wettings are best. Such practice will also save packing the filled pump up the hill more

than is absolutely necessary. In freezing weather a good dose of water sluiced in at the top end at quitting time will insure an iced surface for the following morning.

Some judgment is required in locating the discharge end. Where the grade exceeds 8 per cent, cordwood sticks will travel a surprising distance after leaving the chute. By giving the last two or three sections an upward pitch similar to a ski-jump take-off, heavy oak cordwood has been made to leap 78 feet. Hence, a little experimenting is needed to give just the correct pitch to the discharge end to make the wood land as closely as possible to the main road. Occasionally a woodrank can be utilized as a stop or bumper.

While the chute is in operation it is decidedly dangerous to be near except where wood is being fed in. We enforce an ironclad rule that no man goes nea the chute except at the feeding point after chuting has stopped. And whe hikers and picnickers are not infrequen we display conspicuous danger signs abo the discharge end.

The saving effected during the first wi ter has already more than paid for th cost of this steel work and the necessa accessories. Four men shot around 45 cords down to the main roads in abo four weeks' time—at a saving of som $250 over the estimated cost of doing th same work with teams—or considerab more than the entire cost of the chute i self.

Following completion of the wint work, the steel chute is oiled and store under cover.

VISIBILITY MAPS CONSTRUCTED WITH THE SLIDE-RULE

By RUDOLPH STAHELIN

University of California, Berkeley, Calif.

The author describes a method for determining the limits of visibility from a mountain lookout point by means of a standard slide-rule used in connection with a topographic map. The slide-rule graduation figures are modified to denote elevations rather than abstract figures.

THE NECESSITY for selecting forest protection lookout points so that the best view of the surrounding timberland area will be obtained requires a study of the topography for determining the proportion between visible areas and those areas that will not be seen. A traditional method, where a topographic map is available, is to prepare profiles along many lines radiating from the lookout point, plotting them on cross-section paper and determining from them by means of a straight edge what areas will be hidden from view. In the method described in this article the graphic way of solving the problem is replaced by a slide-rule operation. An ordinary one-dollar Mannheim slide-rule may be used for this purpose.

Referring to Figure 1, the principle of visibility demands that if point B shall be seen from the lookout point S, then the angle, which the line of sight from S to B forms with the horizontal plane through S, must be smaller than the angle of the line of sight from S to the intermediate point A. Instead of saying that the angle must be smaller, one can say:

1. That the tangent of the angle must be smaller, or

2. That the cotangent of the angle must be larger, or

3. That the ratio of the distance from S to the point sighted and the difference of elevation between these two points must be larger. The three statements are identical as to effect.

It is the ratio of distance to difference of elevation that one finds with the slide-rule in the method here described. The upper or A-scale may be regarded as denoting distances and the top scale of the slide or tongue (the B-scale), represents differences in elevations. The use of the standard slide-rule necessitates mental subtraction to determine the differences of elevation. To obviate this mental work one writes in the actual elevation figures (not the corresponding differences of elevation) for a specific lookout on the B-scale of the slide rule tongue. Where a blank slide-rule cannot be obtained, the slide-rule gradations, properly marked for contour of elevation increments, may be written on a strip of paper and this strip slipped under the glass of the finder and used as the sliding B-scale. Figures 2 shows a strip of two cycle semi-logarithmic paper, which may be used as a slide-rule.

Points examined on the map along a line radiating from the lookout are visible as long as the ratio defined in statement 3 becomes increasingly larger as determined by setting, on the slide-rule, the elevations under the distances from the lookout; in other words, as long as the tongue of the slide-rule moves to the right. As soon as one has to move the slide to the left, one knows that the point will be invisible, since the ratio will be smaller. The actual reading of the ratio, or the cotangent of the angle, is unnecessary, because the direction of the movement of the slide is sufficient to indicate visibility.

A study of the example given in Figure 1 will best explain the procedure. The elevation of the observer in the lookout tower is 1,800 feet. On the B-scale of the

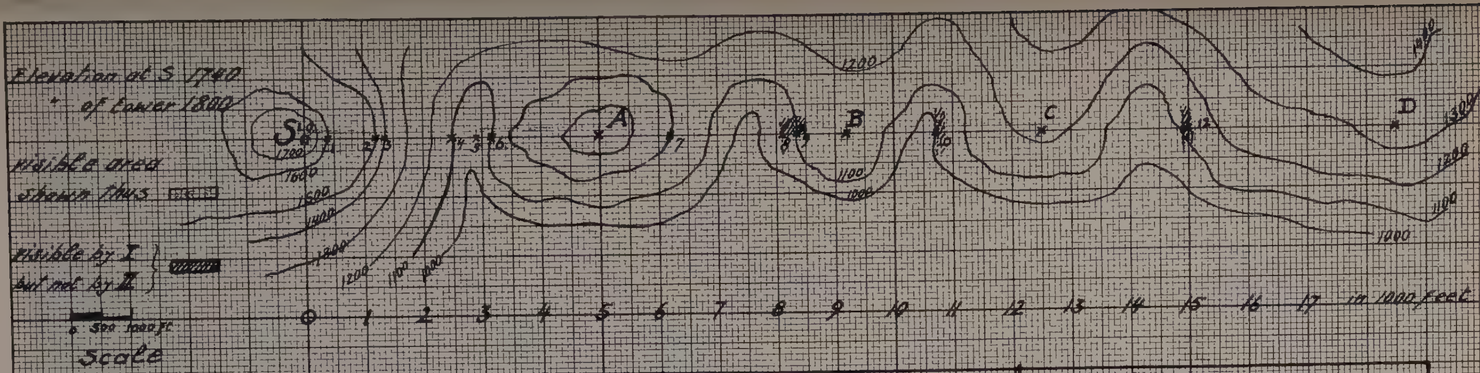
slide-rule are written the elevations with hundreds as units. On the first line corresponding to 1, write 1,700, which is 1,800 minus 100. On the line corresponding to 2, one writes 1,600, which is 1,800-200, and so forth. To read values for elevations from 1,700 to 1,800 feet, the scale of the first cycle of the B-scale must be doubled as shown by Figure 2. According to the same principle one writes down the elevations for contours higher than that of the lookout point.

The operation is indicated by the first section of the table on Figure 1. Starting with the interception of the 1,600-foot contour at 400-feet distance from S, set 1,600 of the B-scale under 400 of the A-scale and read 2.0 on the A-scale over 1,700, which is the original 1 of the B-scale. 2.0 is the cotangent of the angle of sight. It is known or assumed that this starting point is visible. For the next reading put 1,500 of the B-scale under 1,200 of A-scale. Since one reads the distances now in units of thousands instead of hundreds, one must use the 1 of the second cycle of the B-scale, which is the line marked by an arrow, and read over it 4.0 on the A-scale as the cotangent. Since the slide had to be moved to the right (4 is larger than 2), this point is visible. For the 1,400-foot contour at 1,300 feet distance from S, one has to move the slide to the left in order to set 1,400 under 1,350. This point is therefore invisible. The 1,500-foot contour is the first limit of visibility. Actually one does not have to move the slide to the left, to see that point 3 on the 1,400-foot contour is invisible. It is sufficient to realize that one *would* have to move it to the left. Therefore one leaves the slide at the setting of the last visible point, which was point 2, and watches the map for the next point, whose distance read on A and whose elevation read on B are opposite on the rule. The table on Figure 1 explains the further procedure.

In case the knoll around point A is blocking the view of much country behind it, it will be important to know, how much the top rises above the last contour line of 1,300 feet given on the map and how much additional obstruction is caused by the forest-cover growing on it. These more important points should be checked up in the field with a transit or Abney level. The elevation of the instrument may be assumed to be the same as the one of S, namely 1,740 feet. The vertical angle SA of 3° 22′ gives a cotangent of 16.9990 or a reading on the A-scale of 17.0. Putting the arrow on the B-scale under 17 on the A-scale, gives 1,510 under 5,000. Five thousand feet is the scaled distance from S to A; 1,510 is then the calculated elevation of the tree tops on point A. From this elevation one must subtract 60 feet for the height of the observation tower, for which the scale was prepared. This leaves 1,450 as the actual elevation of the tree tops at point A, which would indicate about 100-foot trees on the knoll. The corrected reading for preparing the visibility map beyond point A will then be 14.4. In section II of the Table the ground is assumed to be covered with a uniform vegetation of 100-foot trees. The shaded strips on the map show the differences between the assumptions of section I and section II. These differences are not very large in this case.

Supposing that the trees were 150 feet tall on A and that there was no vegetation at B (see Table, section III), then the ridge at B would not be seen at all. An observer in the tower at S sees a fire between C and D. Counting the ridges from his viewpoint he would only see A and C. The map prepared from topographic data alone however would show A, B and C visible. He would therefore locate the fire as being between B and C instead of between C and D.

Mr. George M. Gowan of the U. S. Forest Service, who is in charge of the Mt. Shasta Experimental Forest, found the slide-rule very efficient for locating



	I Based on contour lines of topographic map only.					Angle observ. with transit at S			II Assuming uniform forest cover of 100 foot trees					III Assuming 150 ft trees at A and no trees at B				
Point	Distance	Elevat.	Reading	visible	invis.	angle observed	Read	correct. ready	Distance	Elevat.	Read	vis.	invis.	Distance	Elev.	Reading	vis.	invis.
1	400	1600	2.0	×														
2	1200	1500	4.0	×														
3	1350	1400	3.4		×													
4	2500	1100	3.6		×													
5	2900	1080	4.0	×														
6	3150	1100	4.5	×														
A	5000	1350	11.1	×		3° 22′	17.0	14.4	5000	1450	14.4	×		5000	1500	16.7	×	
7	6200	1200	10.4		×				8100	1175	13.0		×					
8	8100	1075	11.1	×					8250	1190	13.4		×					
9	8350	1100	11.8	×					8500	1210	14.4	×						
B	9200	1150	14.2	×					9200	1250	16.7	×		9200	1150	14.2		×
10	10700	1040	14.2	×					10800	1150	16.7	×						
C	12500	1230	22.0	×					12500	1330	26.8	×						
11	14900	1120	22.0	×					15000	1250	27.3	×						
12	15000	1150	23.2	×														

Fig. 1.—Demonstration of visibility determination for assumed conditions.

limits of visibility and checking visibility maps in the field. In his application of the slide-rule a mental interpolation, for converting elevations to differences of elevation, is required. To use the tangent or Abney level grade per cent reading, he uses the A-scale for elevations and the B-scale for distances. To locate on the map a point sighted in the field, he puts the beginning of the second cycle of the B-scale directly under the Abney reading on the A-scale. Any point on the map, whose elevation and distance are opposite each other on the slide-rule, lies in the line of sight. The point where the line of sight hits the ground (or vegetation) can then be located easily on the map by watching the contour lines in connection with the scaled distances.

The setting of the slide-rule is then:

$$\frac{\text{Difference in elevation}}{\text{Distance}} = \frac{\text{tangent}}{1} \quad \text{or}$$

$$\frac{E}{L} = \frac{t}{10} \quad \text{where}$$

E = difference in elevation read in 100 feet

L = horizontal distance read in 1,000 feet

t = tangent read in per cent

Taking point B from section I of the Table in Figure I, we have

$$\frac{650}{9200} = \frac{7}{100} = 7 \text{ per cent}$$

The slide-rule setting is then

$$\text{mathematically } \frac{6.5}{9.2} = \frac{7}{10}$$

$$\text{actually } \frac{1150}{9.2} = \frac{7}{10}$$

We do not look on 650, but on 1,150 (= 1,800 — 650), the elevation corresponding to the difference of elevation of 650 feet, which we have previously written with pencil on the A-scale as we have done for all contour elevations.

Where miles are used as units in scal-

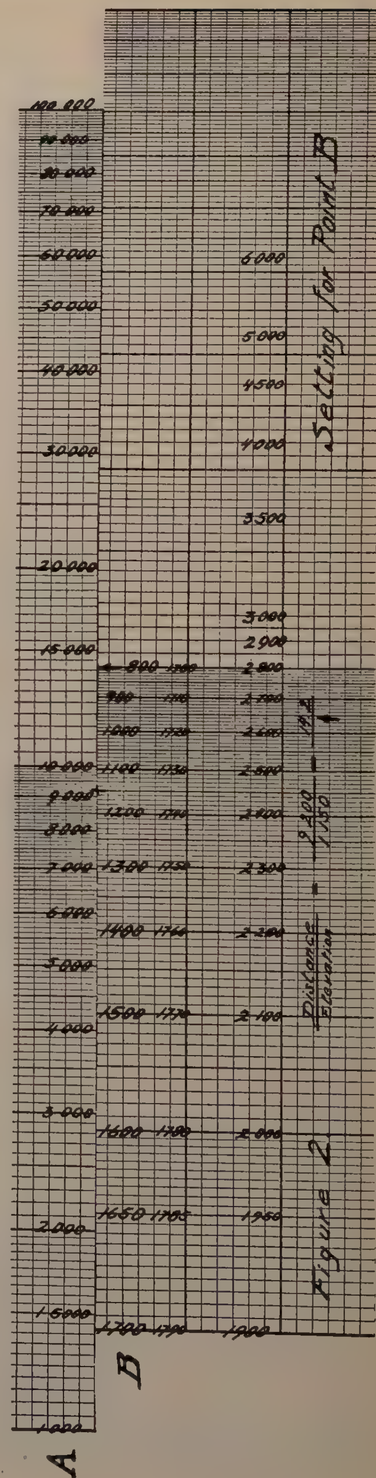


Fig. 2—Sample setting of slide rule for determining visibility.

ng on the map, 1.894 of the B-scale must be set under the Abney reading on the A-scale, in order to read the elevations over the corresponding distances in miles. Setting mile-units for L, which was in units of 1,000 feet, we have:

$$\frac{E}{L \times 5.280} = \frac{t}{10}; \quad \frac{E}{L} = t \times .5280;$$

$$\frac{E}{L} = \frac{t}{1.894}$$

Lines corresponding to the Abney per cent reading of the angle of sight may be drawn on the visible areas on the map. From the per cent reading of the instrument the lookout man can locate the fire on the map, since there is only one line of the same per cent crossing the line of sight, except in those cases, where the particular per cent coincides with two limits of visibility. These lines are also a great help for a new man on a tower in getting acquainted with the country.

"Allow me, forester, to tell you that you have both an ancient and honourable trade; and as trees far outstrip the life of man, if you do your profession justice, they will testify to your memory and speak peace to your ashes after you are gone; if you do not every forsaken twig will blast your fame. To some foresters I can say, 'well done good and faithful servant'; but to others I may say 'How long wilt thou sleep, O sluggard, when wilt thou awake out of thy sleep'?"

From *The Forester's Guide*, by Robert Monteath, London, 1836.

A METHOD FOR DETERMINING THE ECONOMIC VALUE OF A FOREST ROAD

By J. P. MARTIN[1] and T. W. NORCROSS[2]

United States Forest Service

To facilitate the determination of whether or not the construction, improvement and maintenance of a road is feasible from a financial standpoint, the authors worked out an outline for the investigation of all pertinent factors affecting roads. As far as the forestry and engineering world is concerned, the method of determining the economic value of a road here described is considered absolutely new. It has been approved by the Forest Service and will be used in determining whether or not a suggested road is to be included in the national forest system, or is to be improved and maintained from forest road funds. The method is systematically and simply presented and an example is given in explanation of its application.

THIS CAN truthfully be called The Road Age. There probably was a previous road age, but if so, its demands while great must have been insignificant when compared to this.

About four hundred years ago—a very brief space of time—there were no roads in the United States. Passageways for man and beast were hardly trails. They were made by animals guided by their own instincts and traveled as well by the American Indian and his predecessors. The Indian had no dreams of better means of travel, but the white man was accustomed to better means of transportation. He was enterprising and wanted a higher scale of living. He wanted to save time and perhaps most of all he wanted to reach out and explore new fields— to conquer new worlds. He built roads and wagons and moved westward until now the entire country is settled and covered with a network of man-made roads.

The Road Age began some twenty to thirty years ago, for then the big expansion started. The motorized vehicle caused the white man to dream again, not so much of new fields, but of greater efficiency, greater comfort and pleasure. And, as time advanced, he added safety. The age started with a rush. Nearly every householder was buying from one to two motors, and was deeply chagrined because he had no place to go. He demanded better roads and greater mileage.

For many reasons private capital, except in minor cases, could not enter this field. The government, both federal and local, was therefore asked to pay.

In the planning and the financing of the modern roads many questions have been asked and satisfactorily answered, but others relating to benefits derived and the economy of the construction and operation have not been settled in a systematic and comprehensive manner, as in the case of industrial plants, railroads, toll bridges and toll roads, etc.

The Forest Service has been building roads to improve and protect the national forests for over twenty years. Its policy reads as follows:

"The savings to traffic and the value of service to traffic and property during the period prior to replacement or abandonment of the road should at least equal the total expenditure on the road during that period. Such expenditure will include not only the construction cost but also maintenance expenditures and interest on and the retirement of the amount invested. Expressed in another way the total expenditure should not exceed the estimated economic return. Recreation travel is considered as having an economic value."

[1]Regional Engineer, Ogden, Utah.
[2]Chief Engineer, Washington, D. C.

In solving the economic road problems of the Forest Service, the following questions arise:

Will the existing road, properly maintained, be adequate for the service required of it, or will further expenditures for reconstruction or betterment be required? Will the value of the service rendered equal or exceed the cost of maintenance plus other annual charges? What is the service that is required and what will be the annual charges to meet that service?

In order to assist in solving the problem certain engineers and others in the Forest Service have given the policy and the questions a great deal of thought and have worked out an outline for determining the economic value of the national forest roads.

The outline which follows is divided into three main parts: First, description of outline; second, table of all data; and third, a sample computation.

Details of the methods employed and the formulae used are contained in the "Description of Outline." All data, known and estimated, are placed in the "Table of All Data" by items for both the existing and the proposed road. For simplification the symbols representing the data as well as the data are placed in the table, the former immediately above the latter. In the "Computations" the formulae given in the "Description of outline" are used, the known data being substituted for the symbols and the unknown quantities derived.

In beginning the economic study of a road, the class of the proposed road is assumed and certain data corresponding to this class are used. After determining the outgo and the values upon this basis, it oftentimes will be necessary to change the standard of the proposed road and repeat the computations upon the new basis until the outgo harmonizes with the values.

Description of Outline for Economic Road Study

General

The outline is prepared for the purpose of facilitating the study of a road project to determine whether or not the construction and maintenance of a new road is a feasible proposition from a financial standpoint. The study may show that a large expenditure will not be feasible and that only a certain amount of improvement of the existing road should be done. It may show also that only this amount of improvement is necessary to serve the expected travel. On the other hand, it will be shown, in many cases, that a large expenditure for a high standard road will be justified.

The outline has been divided into seven sections as follows:

Section 1—Table of collected data.

Section 2—Outgo or costs of the road.

Section 3—Classification of roads.

Section 4—Savings in operation and travel time for cars and trucks for each class of travel.

Section 5—Recreation values.

Section 6—Administration, utilization and protection values.

Section 7—Summary of values and comparison of them with estimated outgo.

Of these values the following are related directly to the national forests through increasing their value or usefulness:

Section 4—Savings in operation of cars and trucks and travel time in the general administration of the forests. Savings in operation of cars and trucks of recreation seekers traveling along the road where the recreation is directly derived from forest resources.

Section 5—Recreation values of the forest resources on non-revenue producing recreation areas determined in terms of man-hours. Such part of recreation values attributable to revenue producing recrea-

tional areas as is or can be secured by leases of national forest property.

Section 6—Other savings in administration of the forests. Such part of savings in grazing utilization as can be secured by increases of grazing fees. Such part of savings in utilization of other forest resources as can be secured by increases of national forest receipts. Such part of annual cost derived from timber appraisal estimate as is applicable to national forest timber. Such part of cost for protection as is applicable to protection of national forest timber.

All remaining values are chargeable to other than forest funds.

SECTION 1—DATA

All collected data used in the study should be placed in this section for ready reference. The data are arranged by classes of use and activities for the existing and for the proposed road.

SECTION 2—OUTGO

If the existing road is being maintained the actual average annual cost should be applied, otherwise it should be estimated. The cost of maintaining and constructing the proposed road should be estimated from the best available information. If reconstruction at a later date to a higher standard than that proposed can be anticipated, except for surfacing, the life of the road should be estimated as ending with the time such reconstruction can be expected to occur, and in such cases a scrap value should be estimated equivalent to the cost of such portion or portions of the proposed road as will enter into and become a part of the reconstruction. In case the existing road is one that had been previously constructed and a higher standard is proposed, the actual scrap value of the existing road should become a part of the construction cost.

Interest should be charged at the rate equivalent to the average cost of money to the United States over a reasonable period of years. This rate might well be taken at 3.5 per cent. It should be applied to the estimated cost of construction plus the scrap value, if any, of the existing road. This rate should also be applied to the net investment in the determination of the annual charge for amortization of the investment at the end of the life of the road.

AFFECTS ALL CLASSES AND TYPES OF ROADS

A = Total annual cost of maintaining present road.

B = Estimated annual cost of maintaining proposed road.

C = Estimated cost of constructing proposed road.

D = Estimated life of proposed road in years.

E = Scrap value of road at end of life. (This pertains to the existing road also if it has been previously constructed by Forest funds.)

a = Rate of interest.

F = C minus scrap value of proposed road plus scrap value of existing road, if any.

G = Average annual interest on investment = a $\times$ (C + scrap value of existing road).

H = Retirement of investment compounded annually $= \dfrac{a \times F}{(1 + a)^{D} - 1}$.

I = Average annual outgo = G + H + B — A.

SECTION 3—PART 1—CLASSES OF ROADS

The roads that the national forests may be expected to consider are divided into five classes to correspond with various types of construction. The types range from double track pavements of concrete or oiled surfaces to such roads as were built before the advent of the automobile but which can be made passable to an automobile or loaded wagon by maintenance.

A definition and description is given below of each type:

V. Fine roads—hard surfaced roads—little or no second gear—first-class alignment and long sustained gradients—where maximum performance of car and truck can be secured and where maximum safety and comfort can be had. Average speed for cars 23 miles per hour or over for mountain travel.

W. Fine roads—good gravel surface or equally good natural surface roads—little or no second gear—good alignment and gradients—nearly equal to V-roads except for capping. Average speed for cars 18 to 22 miles per hour for mountain travel.

X. Good roads—dirt or poorly graveled roads—fair alignment but gradient changing frequently at fairly long intervals—not smooth under ordinary conditions—about 20 per cent second and first gear—average speed 12 to 18 miles per hour.

Y. Fair roads—dirt surface—rough or not smooth and of only fair traction—considerable first and second gear—more or less contour alignment, gradient breaks frequently. Average speed 10 to 12 miles per hour.

Z. Poor roads—roads usually built before the advent of the automobile but over which an auto or loaded wagon can be taken.

PART 2—TRANSPORTATION COSTS AND SPEEDS

In selecting basic cost data, as contained in Table 1, a study was made of tests on cars and trucks conducted by other agencies and such modification was made to the results obtained as seemed to suit the conditions of the National Forests. The costs for the Z-roads were entirely estimated but their relation to the known costs on other types of roads seems reasonable.

In case data of cost of transportation over present roads or over roads constructed similarly to the proposed road in the same region are not available, the data in Table 1 can be used, modified to suit costs of gas, etc., and other conditions of the region.

Table 2 contains estimated speeds of cars and trucks over the various classes of roads. This table was also prepared from a study of tests made by other agencies and observations of forest officers.

Above estimates are based on 20-cent gasoline and the cost of gasoline being about 20 per cent of the total cost of operation exclusive of the cost of driver. The minimum figures on the table are for regions in the vicinity of main railroad cities where tires and parts are comparatively cheap. The maximum figures are for regions far from main railroads where these costs are comparatively high. Therefore, variations should be made within the limiting figures given above as follows: Vary within the figures in order to conform to the comparative maintenance costs of the region. Add or deduct from such figures to allow for the comparative cost of gasoline. This variation for 35-cent gasoline would amount to $\frac{15}{20}$ times 20 per cent times the minimum figure given in the table. ($\frac{15}{20} \times .20 \times$ minimum.)

TABLE 1

BASIC TRANSPORTATION COSTS IN CENTS

(Exclusive of salary and expenses of driver)

Class of travel	Classes of roads V	W	X	Y	Z
Cars, per mile	9.0–11.7	10.7–13.7	12.0–15.6	13.0–17.0	18.0–24.0
Trucks, per gross ton-mile	5.6– 7.6	6.2– 8.5	7.0– 9.6	8.0–11.0	11.0–16.0

For freighting by trucks, the figures are based on full loads both ways. Allowance should therefore be made for cases where full loading is not had for the round trip, as follows: Estimate the actual gross ton-miles and also the gross ton-miles as if the trucks were loaded to full capacity both ways. Let these figures be represented by M and N, respectively. Let O represent the basic figure in Table 1. The revised cost per gross ton-mile (P) would be $O + (50 \text{ per cent times } \frac{N - M}{N} \text{ times } O)$, (50 per cent being an arbitrary figure). Variation should also be made for the cost of gasoline and remoteness of the region in a manner similar to that followed in the case of cars.

SECTION 4—SAVINGS IN OPERATION AND TRAVEL TIME

In this section the savings in the cost of operation of cars and trucks and the value of the time saved by the travelers are determined. The travel is divided into the following classes:

(a) Business.
(b) Non-revenue producing recreation.
(c) Revenue producing recreation.
(d) Forest administration.
(e) Forest grazing—utilization and exploitation.
(f) Utilization of other forest resources.

In (a) are considered through travel, intercommunity travel, tourist travel to a destination outside the Forest where no recreational values are obtained by the traveler from scenic or other forest resources along the road, store keepers, mines and other business enterprises not connected with the forest resources. Recreation values received along the road are determined in Section 5, Part 3a.

In (b) are considered savings in operation of cars and trucks of recreation seekers in reaching non-revenue producing recreation, also savings in travel time unless and to the extent recreation values are received by the travelers along the road. Recreation values received along the road are determined in Section 5, Part 3a.

In (c) are considered the savings in operation of cars and trucks in reaching revenue producing recreational areas and also savings in travel time unless and to the extent recreational values are received by the travelers along the road. Recreational values are determined in Section 5, Part 4.

In (d) are considered savings in operation and time in travel of forest officers and trucks on national forest work within the region. Other savings are determined in Section 6.

In (e) are considered savings in operation and time of stockmen in travel and in transportation of supplies, etc., needed in the management of their stock. Other savings are determined in Section 6.

In (f) are considered the savings in operation and time in travel in the construction, maintenance and operation of other enterprises utilizing forest resources, such as water power and irrigation, etc. Timber utilization will not be included under this head but upon a different basis as outlined under Section 6.

TABLE 2

TIME OF TRAVEL IN MILES PER HOUR

Class of travel	Classes of roads				
	V	W	X	Y	Z
Cars	23 and over	18–22	12–18	10–12	9 or less
Trucks	18	15	10	6	5 or less

PART 1—TRANSPORTATION COSTS AND INCOME FROM OPERATION OF CARS

(For each class of travel except timber utilization and protection.) (Include tourist cars anxious to make time and speeding to a distant point, where no recreation value is derived while traveling along the road.)

Data

For costs of transportation and speeds refer to Section 3, Part 2, and for classes of roads to Section 3, Part 1.

Present road

A = Length of trip in miles (one way).

B = Average cost per car mile (exclusive of time of travelers).

C = Time required for trip (one way). (Considered average speed.)

D = Value of time of travelers per hour. (Average may be $1.00.)

a = Number of travelers per car (usually 2 for business and 3 to 4 for pleasure).

E = Value of time of travelers per trip = C × D × a.

Proposed road

F = Length of trip in miles (one way). (This may differ from length of present road.)

C = Estimated average cost per car mile (exclusive of time of travelers).

H = Number of trips per year. (Estimate from study of present travel and conditions.)

I = Time required for trip (one way). (Consider average speed.)

K = Value of time of travelers per trip = I × D × a (Average may be $1.00 per hour).

The Operation

Present road

L = Car miles per year = H × A.

M = Annual operating cost = L × B.

(In above, use number of cars estimated over proposed road, not over existing road.)

Proposed road

N = Car miles per year = H × F.

O = Annual operating cost = N × G.

Annual income from operation.

P = M — O.

Value of Time

(Consider recreationists' time as valuable in part, provided some of the road is through a region not valuable for recreation purposes.)

Present road

Q = Value of time of travelers per year on road = H × E.

(In above, use number of trips estimated over proposed road, not over existing road.)

Proposed road

R = Value of time of travelers per year on road = H × K.

Annual income from value of time

S = Income per year = Q — R.

Total annual income

T (Total Income) = P + S.

PART 2—TRANSPORTATION AND INCOME FROM OPERATION OF TRUCKS

(For each class of travel except timber utilization and protection.)

Data

For costs of transportation and speeds, refer to Section 3, Part 2, and for classes of roads, Section 3, Part 1.

(Divide the data into classes of travel.) (See first paragraph, Section 4.)

Present road

A = Length of trip in miles (one way).

B = Average cost of transportation per gross ton-mile. (B excludes personal services.) (See Section 3, Part 2.)

D = Average tare weight of one truck.

E = Average capacity of one truck.

a = Proportional part of one-way trip the trucks are loaded to capacity (i.e., if loaded to full capacity one way and one-half capacity the other, *a* would be 1.5.

G = Value of time of driver and passengers per trip (average may be $0.75 per hour).

Proposed road

H = Length of trip in miles (one way).

I = Estimated average cost of transportation per gross ton-mile. (*I* excludes personal services.) (See Section 3, Part 2.)

K = Estimated *net* tonnage per year. (One way—the maximum.)

Kr = Estimated net tonnage per year. (Return trip.)

L = Estimated average tare weight of a truck.

M = Estimated average capacity weight of a truck.

b = Proportional part of one-way trip the trucks are loaded to capacity.

Then Operation

Present road

$$a = 1 + \frac{Kr}{K}.$$

P = Gross ton-miles per *round* trip = A(2D + [a × E]).

$$Q = \text{Number of round trips} = \frac{K}{E}.$$

(Use tonnage over proposed road, not tonnage over existing road.)

d = Speed of trucks (See Section 3, Part 2).

Proposed road

R = Gross ton-miles per *round* trip = H(2L + [b ×M]).

$$S = \text{Number of round trips} = \frac{K}{M}.$$

e = Speed of trucks (See Section 3, Part 2).

Income (operation)

T = Cost of operating for years (present road) = Q × P × B.

U = Cost of operating for year (proposed road) = S × R × I.

V = Income for year = T — U.

Value of Time of Driver

Present road

W = Value of time or driver on present road = Number of round trips times length of round trip divided by the speed times value of time of driver per hour

$$= Q \times \frac{2A}{d} \times G.$$

Proposed road

X = Value of time of driver on proposed road $= S \times \frac{2H}{e} \times G.$

Y = W — X = Income from value of time.

Total income (operation and time)

Z = Total annual income = V + Y.

SECTION 5—RECREATION VALUES—PART 1—SCALE OF AREA VALUES

Attractive areas on the forests have been divided into four classes according to their relative merit for recreation purposes and certain values per capita per hour and per day have been assigned to each. In classifying an area, consideration should be given to other areas in the same region that are valuable for recreation purposes and classification given that is proportional to its relative merit.

In many cases the road will have recreational values within itself, i.e., it may follow a stream valuable for camping or fishing purposes or it may traverse a region having scenic values, or, as far as recreation is concerned, it may be for the purpose of reaching an area valuable for recreation, or it may traverse a recreational region and also be for the purpose of reaching an areas of special importance for recreation.

In selecting values for each class of area, it was considered advisable to avoid extortionate amounts and also purely nominal ones. The charge made for an automobile entering Yellowstone National Park is probably equivalent approxi-

nately to $1.25 per day per person, and t is believed therefore that the scale of values selected for forest areas are reasonable. An investigator using the economic outline is at liberty to change the values selected if he has a sound basis for the change that can be substantiated.

It has been found that for business travel the number of passengers per car can be considered as two, and for pleasure three to four inclusive of driver.

Selected Value of Areas

M—Areas of greatest attraction considering scale of attractions available in the region—20 cents per capita per hour or maximum of $2.00 per capita per day.

N—Very attractive regions—15 cents per capita per hour or maximum of $1.50 per capita per day.

O—Attractive regions—10 cents per capita per hour or maximum of $1.00 per capita per day.

P—Ordinary regions but that are used for recreation—5 cents per capita per hour or 50 cents per day.

(Above values are net and do not include the values of artificial accommodations or cost of operating autos.)

PART 2—SCALE OF ROAD VALUES

A high class road is more valuable for recreational purposes than a low class road and it is therefore felt the class of road traversing an area of value for recreation or leading to such an area has a direct bearing upon the recreational value of the area. In the outline, this relation has been expressed in terms of per cent to be applied to the per capita values given in Part 1. In determining the various percentages, the highest type of road, V, was considered as furnishing 100 per cent values, while road Z was considered as furnishing zero values. For the intermediate types of roads, W, X and Y, the percentages are proportional to the speed spreads as given below:

Road	Average speed	Speed spread	Per cent
V	23	14	100
W	20	11	80
X	15	6	40
Y	11	2	15
Z	9	0	0
—	—	—	—
Spread	14		100

The percentages to be applied to the values given above under the heading "Selected Value of Areas" for the various types of roads are therefore as follows:

V for V—Roads = 100 per cent for speeds not in excess of 23 miles.

W for W—Roads = 80 per cent of values in Part 1.

X for X—Roads = 40 per cent of values in Part 1.

Y for Y—Roads = 15 per cent of values in Part 1.

Z for Z—Roads = 0 per cent of values in Part 1.

PART 3—NON-REVENUE PRODUCING RECREATION

In this Part, values dependent upon revenue producing use are excluded. These values are determined in Part 4.

The values of recreational travel over the road to reach an area of recreational value in terms of travel time and savings in operating costs of cars and trucks have been determined in Section 4.

In this Part determination is made (1) of the recreational values while traveling along the existing road and also along the proposed road, and (2) the value of the recreational areas while camping, fishing or otherwise enjoying the area, when not traveling. In both cases the values given in Section 5, Part 1, are applied, but in the former case the percentages given in Section 5, Part 2, are also utilized.

PART 3a—WHILE TRAVELING ON ROAD

(Exclude from this Part, tourist travel where the object of the travel is to reach

a point outside the forest or a revenue producing recreation area within the forest unless recreational values are derived from the travel and recreation due to revenue producing recreational areas.)

Present road

A = Number of cars using the present road for recreational purposes annually.

a = Average number of persons per car (3 or 4).

B = Average number of hours or days in travel per car.

C = Value of area along road for recreational purposes, taking into consideration the class of existing road = A × B × a × (M or N or O or P) × (V or W or X or Y or Z). ((Parts in brackets are value of area and percentage for type of road, the latter expressed in decimals.)

Proposed road

D = Estimated number of cars which will use the road for recreational purposes annually.

b = Average number of persons per car (3 to 4).

E = Estimated average number of hours or days in travel per car.

F = Value of area along road = D × E × b × (M or N or O or P) × (V or W or X or Y or Z).

G = Annual income = F — C.

PART 3b—WHILE NOT TRAVELING ON ROAD

Present road

A = Number of persons using the area annually for recreational purposes.

B = Average number of hours or days in area per capita.

Then C = Value of area with present transportation facilities = A × B × (M or N or O or P).

Proposed road

D = Estimated number of persons who will use the area annually for recreation purposes with proposed road.

E = Estimated number of hours or days in area per capita.

Then F = Value of area with proposed transportation facilities = D × E × (I[...] or N or O or P).

Then G = Annual income = F — C[...]

Total income

H = Income of Part 3a (G) + Incom[...] of Part 3b (G).

PART 4—REVENUE PRODUCING RECREATIO[...]

The values of the existing and the pro[...]posed roads to land holders, leasees, per[...]mittees, etc., managing some phase [...] recreational use for profit in terms o[...] savings in time and operation of cars an[...] trucks are determined in Section 4. I[...] this Section the values of the recreationa[...] use of the natural resources as enhance[...] by the facilities of the landholders or per[...]mittees should be determined. If relativ[...] data in each special case are not availabl[...] the values should be determined from th[...] per capita values given in Section 5, Part 1[...] These values, however, should not b[...] greater than the increased net profits o[...] the landholder and permittees due to th[...] increase of travel by virtue of the con[...]struction of a higher type of road.

Include travel that uses the road and[...] enjoys the natural resources virtually o[...] account of facilities supplied by the land[...]holder or permittee and extension of time[...] in area due to these facilities.

Employ outline as in Part 3b.

H = Total annual income.

SECTION 6—ADMINISTRATION, UTILIZATION AND PROTECTION—PART 1—ADMINISTRATION

The savings in time and operation of cars and trucks in the general administration and improvement of the region is determined in Section 4. Other savings in horsehire, forage, subsistence, personal expenses, in connection with improvement, maintenance, etc., should be estimated from the best data available and placed in this Part.

A = Estimated annual savings in cost of horsehire, forage, subsistence, maintenance of improvement as buildings and

telephone lines, etc., and all personal expenses. except travel (travel being included in Section 4), that will be connected with administering the area tributary to the road during E years; provided road is built to the required standard. (Consider uses, timber utilization, grazing, improvements, etc.)

PART 2—TIMBER UTILIZATION

The amount that can be charged against the road for timber within the area depends on the value of the road to the chance and must be obtained from a timber appraisal of the area. The annual charge would be the interest and the amount that must be set aside annually to amortize the cost to timber during the estimated life of the road, consideration being given to scrap values and maintenance.

The data for timber utilization would be taken from the timber appraisal and computations made as in Section 2, Outgo.

A = Annual cost of maintaining present road.

B = Estimated annual cost of maintaining proposed road.

C = Estimated cost of constructing proposed road.

D = Estimated life of proposed road in years.

E = Scrap value of road at end of life. (Scrap value relates also to the present road if it has been previously built by National Forest funds.)

a = Rate of interest.

F = C minus scrap value of proposed road plus scrap value of existing road, if any.

G = Average annual interest on investment = a × (C + scrap value of existing road).

H = Retirement of investment compounded annually $= \dfrac{a \times F}{(1+a)^D - 1}$.

I = Average annual cost = G + H + B — A.

PART 3—FOREST GRAZING—UTILIZATION

Saving in operation of cars and trucks and time of travel are considered in Section 4. Other savings due to reducing the time and expense of transporting stock to and from the range, including cost of return of ewes to range or of feeding them in pasture if considered more economical, in savings in weight of stock during transportation, in reducing losses by use of better transportation methods, in being better able to get stock to market quicker to meet high prices, etc., are considered.

In case an existing road is available, the cost of its improvement so that it can carry stock, etc., must be weighed against the use of a driveway with its contingent losses. Also the value of the construction of a higher type of road for stock purposes must be considered, especially where a higher type road is proposed for other purposes.

A = Annual savings in time and expense of transporting stock.

B = Annual savings made in not requiring return of ewes to range or cost of feeding them.

C = Annual savings in weight of stock moved.

D = Annual savings in losses of stock.

E = Annual savings in meeting high prices.

F = Other annual savings.

G = Total annual savings = A + B + C + D + E.

PART 4—UTILIZATION OF OTHER FOREST RESOURCES

The study of the utilization of other forest resources should be similar to that for grazing, administration, etc., including such savings as can be attributed to the construction of the road in addition to what can be determined in Section 4.

A = Estimated savings as are applicable derived from transportation by cars and trucks and other sources.

PART 5—PROTECTION

The determination of the value of the road for protection will be based upon the transportation study of the tributary area involving hour control. The road would be of such standard as would satisfy the hour control specification with the least annual cost.

A = Annual estimated cost of the road as determined by the transportation study of the transportation facilities of the region which would give the specified hour control at the least annual cost.

SECTION 7—SUMMARY

In the summary the outgo and incomes are tabulated in brief form so that a comparison between them and the values for National Forest and other purposes can be readily determined.

Example in Application of Economic Study Outline

SECTION 1 — TABLE OF ALL DATA

Item	Existing Road	Total	Proposed road a	b	c	d	e	f
Outgo (Section 2)								
Maintenance costs	A $1,500	B $4,400	—	—	—	—	—	—
Construction cost	—	C $200,000	—	—	—	—	—	—
Life of road (years)	—	D 20	—	—	—	—	—	—
Scrap value	E $5,000	E $40,000	—	—	—	—	—	—
Annual interest rate	—	a 3½	—	—	—	—	—	—
Travel—cars—Section 4, Part 1								
Class of road	Y	W						
Length of trip	A 20	—	F 22	22	22	20	16	—
Cost per car—mile	B .15	—	G .123	.123	.123	.123	.123	—
Time of one-way trip (hours)	C 2.0	—	I 1.1	1.1	.9	1.0	.8	—
Value of time per hour	D $1.00	—	D $1.00	$1.00	$1.00	$1.00	$1.00	—
Number of travelers per car	a	—	a 2.	3.	3.	2.	2.	—
Number of trips per pear	—	—	H 1,000	3,000	1,200	100	500	—
Gas per gallon	g .35	g .35	—	—	—	—	—	—
Transportation of trucks—Section 4, Part 2								
Length of trip (miles)	A 20	—	H 22	—	18	20	16	—

Item	Existing Road	Total	Proposed road a	b	c	d	e	f
Cost per gross ton-mile (cents)	B .10	—	I 6.0	—	6.0	6.0	6.0	—
Tare weight of 1 truck (tons)	D 1	—	L 2	—	2	1½	2	—
Cap. weight of 1 truck (tons)	E 1	—	M 2	—	2	1½	2	—
Capacity loading factor	a 1.5	—	b 1.5	—	1.5	1.5	1.5	—
Value of time of travelers (per mile)	G .80	—	G .80	—	.80	.80	.80	—
Net annual tonnage (1-way maximum)	K 1,000	—	K 500	—	300	100	100	—
Net annual tonnage (return)	Kr 500	—	Kr 250	—	150	50	50	—
Speed of trucks	d 10	—	e 18	—	—	—	—	—
Recreational area values (Sec. 5)	M $.20	—	—	M $.20	—	—	—	—
Recreational road values	Y 15%	—	—	W 80%	—	—	—	—
Part 3a								
Number of cars annually	A 300	—	—	D 600	—	—	—	—
Number of persons per car	a 3	—	—	b 3	—	—	—	—
Number of hours traveling	B 2.2	—	—	E 1.2	—	—	—	—
Part 3b								
Number of persons annually	A 300	—	—	D 700	—	—	—	—
Number of hours per capita	B 6	—	—	E 8	—	—	—	—
Revenue—producing recreation (Part 4)								
Number of persons annually	A 1,000	—	—	—	D 5,000	—	—	—
Number of hours per capita	B 12	—	—	—	E 18	—	—	—
Administration of forest (Section 6, Part 1)								
Savings other than travel annually	—	—	—	—	—	A 500	—	—
Timber utilization (Part 2)								
Estimated annual maintenance	A 500	—	—	—	—	—	—	B 1,000
Estimated cost of road	—	—	—	—	—	—	—	C $60,000
Life of road (years)	—	—	—	—	—	—	—	D 15

Item	Existing Road	Total	Proposed road a	b	c	d	e	f
Scrap value	E $6,000	—	—	—	—	—	—	E C a
Interest rate	—	—	—	—	—	—	—	3½
Grazing utilization (Part 3)								
Savings in transportation of stock	—	—	—	—	—	—	A $1,000	—
Savings in no return of ewes	—	—	—	—	—	—	B 500	—
Savings in weight of stock moved	—	—	—	—	—	—	C 1,000	—
Savings in losses of stock	—	—	—	—	—	—	D 100	—
Savings in meeting prices	—	—	—	—	—	—	E 25	—
Other savings	—	—	—	—	—	—	F 0	—
Utilization of other resources (Part 4)	—	—	—	—	—	—	—	A 0
Protection (Part 5)								
Annual cost from transportation study	—	—	—	—	—	—	—	A $5,000

Of the total annual income derived the following are chargeable to national forest property:

(a)	Business	None
(b)	Non-revenue producing recreation	Total
(c)	Revenue producing recreation	30 per cent of total
(d)	Forest administration	Total
(e)	Grazing utilization	Savings in operation of car and truck and travel time
(f)	Utilization other resources	None
	Timber utilization	75 per cent
	Protection	90 per cent

Example of Computations

Section 2, Outgo

$$F = C - E + E = 200{,}000 - 40{,}000 + 5{,}000 = \$165{,}000$$
$$G = a \times (200{,}000 + 5{,}000) = .035 \times 205{,}000 = \$7{,}175$$
$$H = \frac{a \times F}{(1 + a)^{D} - 1} = \frac{.035 \times 165{,}000}{(1.035)^{20} - 1} = \frac{5775}{.99} = \$5{,}830$$
$$I = G + H + B - A = 7175 + 5830 + 4400 - 1500 = \$15{,}905$$

SECTION 4, PART 1, CARS

Operation	a	b	c	d	e	f
Present road $E = C \times D \times a =$	4	6	6	4	4	—
Proposed road $K = I \times D \times a =$	2.2	3.3	3.3	2.2	2.2	—
Present road						
$L = H \times A =$	20,000	60,000	24,000	2,000	10,000	—
$M = L \times B =$	$3,000	$9,000	$3,600	$300	$1,500	—
Proposed road						
$N = H \times F =$	22,000	66,000	26,400	2,000	8,000	—
$O = N \times G =$	$2,706	$8,118	$3,247	$246	$984	—
Income $P = M - O =$	294	882	353	54	616	—
Value of time						
Present road $Q = H \times E =$	$4,000	$18,000	$7,200	$400	$2,000	—
Proposed road $R = H \times K =$	2.200	9,900	3,960	220	1,100	—
Income from time						
$S = Q - R =$	$1,800	$8,100	$3,240	$180	$900	—
$T = P + S =$	2,094	8,982	3,593	234	1,516	—

SECTION 4, PART 2, TRUCKS

	a	b	c	d	e	f
Present road $P = A(2D + [a \times E]) =$	70	—	70	70	70	—
$Q = \frac{K}{E} =$	500	—	300	100	100	—
Proposed road $R = H(2L + ([b + M]) =$	154	—	126	140	112	—
$S = \frac{K}{M} =$	250	—	150	50	50	—
Income from operation						
Present road $T = Q \times P \times B =$	$3,500	—	$2,100	$700	$700	—
Proposed road $U = S \times R \times I =$	$2,310	—	$1,134	$420	$336	—
Savings $= V + T - U =$	1,190	—	966	280	364	—
	a	b	c	d	e	f
Value of time of driver $W = Q \times \frac{2A}{d} \times C =$	$1,600	—	$960	$320	$320	—
$X = S \times \frac{2H}{e} \times G =$	489	—	240	90	71	—
$Y =$ Income $= W - X =$	1,111	—	720	230	249	—
Total Income $Z = V + Y$	2,301	—	1,686	510	613	—

SECTION 5, PART 3a, RECREATION VALUES

Present road, $C = A \times B \times a \times$ (M value) $\times$ (Y road present) $= 300 \times 2.2 \times 3 \times$
$.20 \times .15 = \$59$
Proposed road, $F = D \times E \times b \times$ (M value) $\times$ (W, road value) $= 600 \times 1.2 \times 3$
$\times .20 \times .80 = \$345$
Income $= G = F - C = 345 - 59 = \$286$

SECTION 5, PART 3b

Present road, $C = A \times B \times$ (M, value) $= 300 \times 6 \times .20 = \$360$
Proposed road, $F = D \times E \times$ (M, value) $= 700 \times 8 \times .20 = \$1{,}120$
Income $= G = F - C = 1{,}120 - 360 = \$760$

SECTION 5, PART 4, REVENUE PRODUCING RECREATION

Present road, $C = A \times B \times$ (M, value) $= 1{,}000 \times 12 \times .20 = \$2{,}400$
Proposed road, $F = D \times E \times$ (M, value) $= 5{,}000 \times 18 \times .20 = \$18{,}000$
G (Income) $= F - C = 18{,}000 - 2{,}400 = \$15{,}600$

SECTION 6, PART 1

A = Annual savings = $500

SECTION 6, PART 2, TIMBER

$F = C - O + 6{,}000 = 60{,}000 + 6{,}000 = \$66{,}000$
$G = 66{,}000 \times .035 = \$2{,}310$

$$H = \frac{a \times F}{(1 + a)^D - 1} = \frac{.035 \times 66{,}000}{(1.035)^{20} - 1)} = \$2{,}330$$

$I = G + H + B - A = 2{,}310 + 2{,}330 + 1{,}000 - 500 =$ $5,140

SECTION 6, PART 3, GRAZING

$G = A + B + C + D + E - F = 1{,}000 + 500 + 1{,}000 + 100 + 25 =$ $2,625

SECTION 6, PART 4, OTHER RESOURCES

A = 0

SECTION 6, PART 5, PROTECTION

A = $5,000

SECTION 7, SUMMARY

Average annual outgo = I = $15,905

Annual income			Forest charge	Non-forest charge
(a) Business. cars T	=	$ 2,094		
trucks Z	=	2,301		
		$ 4,395	—	$ 4,395
(b) Non-revenue recreation cars T	=	8,982		
trucks Z	=	0		
Recreation values G	=	286		
Recreation values G	=	760		
		10,028	$10,028	—

(c) Revenue recreation cars T	=	3,593		
trucks Z	=	1,686		
Recreation values G	=	15,600		
		20,879	6,264	14,615
(d) Administration cars T	=	234		
trucks Z	=	510		
Other savings A	=	500		
		1,244	1,244	....
(e) Grazing, cars T	=	1,516		
trucks Z	=	613		
Other savings G	=	2,625		
		4,754	2,129	2,625
(f) Other resources			0	0
Timber utilization I	=	5,140	3,855	1,285
Protection A	=	5,000	4,500	500
		10,140	8,355	1,785
Totals		$51,440	$28,020	$23,420

FOREST LANDS AS INVESTMENTS FOR INSURANCE COMPANIES[1]

By P. A. HERBERT

Professor of Forestry, Michigan State College, East Lansing, Mich.

How does forest property meet the investment requirements of insurance companies? The author analyzes the possibilities of such investment. Although he feels that they are not good at present, except in some degree for land carrying merchantable timber, he is optimistic that the time will come when forest land, managed on a sustained yield basis and insured against fire, will be accepted as an important method of investment for insurance companies.

INSURANCE organizations, especially those dealing in life insurance, must have a very conservative investment policy. Their obligations to the policy holders are never liquidated; the insured is just as much, if not more, interested in the financial soundness of the organization fifty years from now as he is today. The sagacity and farsightedness of the investment committee of its board of directors is one of the keystones of a successful insurance company.

Security of the capital is the cardinal principle of insurance investments. Any organization which obligates itself in return for small recurring payments to pay at stated or irregular intervals large sums amounting to the total of these payments with interest must exercise great care that its funds are safely invested.

Insurance companies depend largely upon their investment returns for their profits and for their dividends, as competition is generally so keen that the underwriting returns are comparatively small. Hence, the rate of interest earned by the investments is second only to security as an index of the efficient management of an insurance organization.

The third important consideration in the investment policy of insurance organizations is liquidity. This consideration differs with the type of insurance written and tends to modify both the policy of security and of interest return. Property insurance companies such as fire and marine, subject to large emergency losses payable in cash within a very limited time, must have a considerable part of their investments in readily marketable securities. Causalty insurance, such as workmen's compensation, must be able to meet rather large losses occurring at unpredictable intervals, but the payment of these losses is usually spread over a period of time. With such organizations the same high degree of liquidity is not so essential although it is necessary that most investments be marketable within reasonable time, a period not to exceed, in case of workmen's compensation, the term of years specified in the compensation law. Finally, we have the life insurance organization where the premium and investment income ordinarily is large enough to meet the costs of conducting the business and its policy payments. Such companies, when large enough and their risks are carefully chosen and well spread, never have excessive losses from a single catastrophy. Even our most disastrous influenza epidemics do not call for cash payments to policy holders in excess of funds readily realizable without the sale of long term investments.

It is obvious from the foregoing that liquidity is an important consideration in property and casualty companies, but need receive only secondary consideration with the large life insurance companies.

[1]Presented at 2nd annual meeting of the Central States Forestry Congress, Cincinnati, Ohio, December 4, 1931.

his statement is supported by the actual ıvestment practice of these three types of nderwriters. The property insurance organizations usually have about 80 per ent of their assets in bonds and stock, ıe casualty companies are a close second vith about 70 per cent, and the life inurance companies come last with approximately 40 per cent. Property and asualty companies have comparatively ew mortgage loans in their investment portfolio; whereas life insurance companies usually have about 40 per cent of their funds so invested.

Another consideration that cannot be ignored in the investment program of an insurance company is the expense of reinvesting funds. Where security, interest returns, and liquidity are equal the insurance executives will usually purchase investments that have a long period of years to run to maturity. This saves in operation costs and when the rate of interest is falling, as it is now, it also tends to keep up the investment earnings because new investments of the same quality usually can only be made at a lower rate of interest.

The final consideration that influences the investment policy of insurance companies are the statute limitations of the several states. Before insurance grew out of its swaddling clothes the public suffered from both unscrupulous and ignorant insurance organizations, so that today every state has a body of laws relating to insurance. These laws usually describe in detail the type of security that companies organized in the state must carry in their vaults. In Michigan, for instance, the capital and the funds accumulated in the course of the insurance business can be invested (1) in bonds or notes secured by mortgage lien upon unencumbered real estate worth at least double the amount loaned, (2) in bonds of the United States, of any state or territory, or of any city, county, school district or other local unit of government provided there has not been a repudiation of debt or interest within the last ten years, (3) in railroad and steamship bonds, (4) in the bonds of other types of public utility companies organized under the laws of the state, (5) in any negotiable paper backed by the securities mentioned above, (6) in farm loan bonds and in notes secured by pledge of stock of national and state banks, and (7) in such foreign government bonds as the securities commission approves.

Having recited in brief the requirements of insurance investments, how does forest property meet them? Forest property as we know it today is largely unimproved property. It consists (1) of land covered with merchantable timber, (2) of land with second-growth timber not yet merchantable but giving promise of a yield in the not too distant future, (3) of cut-over land with adequate stocking or land recently forested which will produce another crop of valuable trees in approximately a rotation and (4) of land which because of fire, ruthless exploitation, or other causes does not now contain an adequate stocking of valuable species to insure a second crop within a rotation without artificial reforestation. Occasionally on properties where actual logging operations are now going on, there are minor improvements in buildings, bridges, and equipment. However, these improvements never represent a large part of the value of a forest property.

Of these forest properties only the merchantable timber lands are valued on the basis of a product or a use with a generally recognizable market value. All other types of forest property are today bought and sold at a wide range of prices. These prices are not a measure of a readily observed utility, but are highly speculative in nature; they are based largely upon the prospect of a yet higher speculative value or a hoped for immediate use for

the property rather than on its "long pull" productivity in terms of wood, game, recreation, and other forest products. This condition seriously affects such property as collateral for insurance investment as measured by the yard stick of security.

Furthermore, as the speculative purchase of properties without an immediate income is dependent largely upon optimism and prosperity, the market for all forest property except merchantable timber-land is very irregular. During periods of depression the salability of such speculative holdings is exceedingly uncertain. Thus, it is clear that although a depression affects the liquidity of all real estate, it reduces the liquidity of forest land with the exception of merchantable timberland, more than income-producing real estate.

Now comes the question of interest. Can forestry property as it is now generally owned and managed pay an interest on its loans of from 4 to 5 per cent, the range usually acceptable to insurance companies? As most forest property today, with the exception of operated merchantable timberland, is not earning any income at all, it is obvious that the interest must be paid from other sources. It seems likely that if the owner has sufficient courage to retain ownership and pay taxes that he would be willing to pay a fair return to an investor who would make it possible for him to extract a portion of his own funds for use elsewhere. There can also be no question that the logger actively engaged in logging merchantable timber will be only too willing to pay these interest charges out of his proceeds if he needs a loan to consumate or extend his operations.

Before passing this interesting point it would be well to inquire into the interest-paying capacity of the exceptional forest property, one that has been acquired to grow trees and to pay its own way in doing so. It must be assumed that the entrepreneur so engaged has sufficient confidence in his ability to obtain a fair return on his own capital and certainly no business man is so lacking in opportunities that he will engage in a business which does not at least promise a return of from 4 to 5 per cent. If that is the case he ought to be willing to pay a nearly similar return on any loan that he makes. Naturally, if the interest rates were lower there would probably be more forest owners looking for loans, but, of course, this would apply to all types of property owners. It seems, therefore, that it is on the basis of security and liquidity, and under present conditions of ownership and use that second growth, cut-over, and denuded forest land would be rejected generally as suitable collateral for insurance investments.

Merchantable timberlands, however, requires further consideration of this discussion, although it may be held by some conversant with the present glutted lumber market, that even such property lacks liquidity and security. However, this is only a temporary condition which should not deter investors; merchantable timber now has and always will have a recognizable value and a ready market. Still there is a draw back from the point-of-view of security, and that is the risk from fire, insect, disease, and wind. While merchantable timber will always have a value there is no assurance that any particular body of it will continue to escape these hazards. It is true that comparable hazards exist in other types of real estate considered good collateral, but there the risk is largely eliminated by insurance. Today, while some forest fire insurance is available, the insurance facilities to underwrite forest property are unsatisfactory and wholly inadequate; there is no way of eliminating these risks to the property. The situation has been recognized and the United States Government, through the Forest Service, has undertaken a systema-

study of the problem. In the meantime, however, the inevitable conclusion that forest property in general is not good collateral for investments of insurance funds.

In reaching this conclusion I wish to make it plain that there are many exceptions to this rule. A well-ordered woodlot, as a part of an operating farm, should certainly be taken into consideration in valuing that property for investment purposes. In such a case the woodlot has the same liquidity as the remainder of the farm, its merchantable timber and even its second growth have definitely recognized values and the hazards from fire, insect, disease, and wind are generally at a minimum.

Another exception is the well regulated forest property managed on a sustained-yield basis. They are so regulated that there is a periodic and continuous income, which, of course, cannot be secured unless steps have been taken to reduce as far as possible the risks previously mentioned. Such properties still lack somewhat in security because insurance facilities are not yet available to absorb the remainder of that risk, and they still lack considerable in liquidity because their number is few and their value as a going concern has not yet been recognized generally.

However, the time will come when all forest land will come under some sort of rational management that will plan to perpetuate its productive use. Before this occurs our governments will be re-organized and refinanced to reduce the tax burden on real estate. The state will finance more of the school, road and welfare expenditures through a personal income tax, the principal tax of the future; the general property tax will continue to finance local government but its levies will be much lower than they are now. Also before all forests are properly managed we will have adequate and complete forest insurance service to bring security to investments in forest property. We will have federal forest land banks issuing bonds on a collateral of insured and managed forest property which will make it possible for insurance companies to obtain more security, the desired liquidity and to aid in the financing of small forest properties which they themselves would not care to undertake. Investment in such forest land bonds and directly in mortgages of the larger forest business will then become an important form of investment for insurance companies. Such investments will be favored especially by life insurance organizations because the owners of forest property will often desire long-time credit arrangements obviating the cost of re-investment. Such long-term mortgages and bonds secured by forest property will not detract either from their liquidity or security as the future use of our forests is no less certain than the future use of our homes and our agricultural lands.

Autogyros for Forest Patrol

An autogyro, powered with a 360 h. p. Wright motor and with King Baird as pilot, has been under contract for air service in forest fire protection for the national forests of Oregon and Washington for the past fire season.

This is the first time that the autogyro has been used for this purpose, according to Regional Forester C. J. Buck, Portland, Oregon.

A METHOD OF STUDYING GROWTH EXEMPLIFIED BY ADIRONDACK SPRUCE AND FIR[1]

By HARRY D. SWITZER
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The author describes a simple and rapid method of making a growth study.

WHEN A timberland owner proposes to put his forest property under management he needs to know more than just the area and volume. He must classify the timber by types. This may be done in several ways, but the owner will find it profitable, if he plans to work the property for long time management, to make an intensive survey of the lands. Such a classification has been described by Recknagel (7).

The next step is to determine what the annual cut may be and still keep the operation on a sustained yield basis. With the area of timber in each type, and rough increment figures, the owner may secure an approximate figure for the total annual growth. If the sustained yield of the whole property is desired, the total merchantable growth, or the growth that may be merchantable in a few years, must be accurately determined. Thereupon, the owner and manager may easily decide what lands should be cut over immediately and what lands should be left to put on growth. The growth figures for each type and condition will indicate where the stand is becoming decadent. Analysis of them will, in many cases, indicate the silvicultural treatment and the length of cutting cycle.

METHODS OF GROWTH STUDY

There are two methods commonly applied to the problem of growth determination. One requires the establishment of permanent sample plots; this method has as its chief merit the accurate determination of mortality, but has the disadvantage that the area covered is not large enough to tell the whole story of growth, and unless great care is taken, mechanical inaccuracies will creep in, such as the failure to measure every tree, or to record the death of a tree. When sufficient area is taken toinsure satisfactory figures and the trees have been properly numbered for identification, the job becomes too burdensome. Another objection to the use of sample plots is the fact that the growth figures are not immediately available.

The second method is much shorter and its accuracy is suitable for most purposes. This method has as its basis the determination of the number of annual rings in the last inch of radius at breast height, by the use of the increment borer. However, the method does not give any information on mortality, and has the further disadvantage that the increment borer (4), even in the hands of a careful

[1]This article sets forth some of the interesting aspects of a study of spruce and fir increment in the Adirondacks. While in no sense conclusive, it points the way to obtaining reasonably accurate data with comparatively little expense. The "slow but sure" method of permanent sample plots must be anticipated by such studies if growth figures are to be immediately available.

It is gratifying to note that in substance the figures given by Switzer confirm those obtained from earlier studies in the same area. It gives confidence in the use of these figures as a basis for management.

Undeniably, we need to know more about growth. The work of younger men in this field should be encouraged—too often the assumption made in management plans have no foundation except guesswork. Such a procedure as Switzer sketches will be found readily applicable in many regions and is to be commended for simplicity and reliability.

H. L. CHURCHILL AND A. B. RECKNAGEL.

orker, is not scientifically exact.

There follows a description of a method : studying growth by increment borings :cently used on the Finch, Pruyn and ompany holdings in the central Adirondacks.

Field Work

The field work consists of boring a ufficient number of trees of the two maor species in each forest type and in ach condition, or group, within each ype. The condition, approximate age, and ny other information of importance conerning the stand should be noted while n the ground. The use of cutting records will portray accurately the history of the stand, if it has been cut over, and they will also help to indicate the best method of treatment.

Computations

With the completion of the field work the average rings per inch should be determined for each diameter class in each forest condition and for each group of data. These preliminary curves will serve to compare the different conditions in the same groups and thus indicate what groups may be combined. When the final decision has been made as to which curves, or sets of data are to be com-

Table 1

NUMBER OF YEARS REQUIRED TO GROW LAST INCH D. B. H.
DATA FROM GROWTH MEASUREMENTS—1931

	B: Lower slope		C: Softwood flat			D: Swamp		E: Hardwood land		
D. B. H.	Virgin	"Old chop"	"Old chop"	Second growth	Girdled	"Old chop"	Second growth	"Old chop"	Second growth	Girdled
Groups[1]	B1 and B2		C1, C2 and C3			D1		E1 and E2		
					Spruce					
6	30	11	18	10	14	22	11	18	9	19
7	20	10.5	13	7.5	12	18	10	18	8.5	13
8	19	10.5	13	7.5	12	18	10	17	8.5	11
9	18	10.5	12	7.5	11	17	10	15	8.5	10
10	17	10.5	12	7.5	10	16	10	13	8.5	9
11	16	10.5	10	7.5	8	15	10	12	8.5	9
12	16	10.5	9	7.5	8	14	10	11	8.5	8
13	16	10.5	8	7.5	7	14	9	10	7	7
14	16	10.5	8	7.5	6	13	9	9	7	7
15	16	10.5	7	7.5	5	—	—	9	—	—
16	16	10.5	6	—	—	—	—	8	—	—
17	16	10.5	6	—	—	—	—	—	—	—
18	16	10.5	—	—	—	—	—	—	—	—
19	16	—	—	—	—	—	—	—	—	—
					Balsam					
6	—	11	14	8	11	20	8	4	9	—
7	—	12.3	12	7	8	16	8.7	6	6	15
8	—	12.3	11	7	8	14	8.7	6	6	13
9	—	12.3	11	7	8	13	8.7	6	6	12
10	—	12.3	10	7	8	13	8.7	5	6	10
11	—	12.3	10	7	8	12	8.7	5	6	9
12	—	12.3	9	7	8	12	8.7	5	6	8
13	—	12.3	9	7	8	11	8.7	5	6	8
14	—	12.3	9	7	8	11	8.7	4	6	7
15	—	12.3	8	7	7	—	—	—	—	—
16	—	12.3	—	7	—	—	—	—	—	—

[1]These refer to the classification in article by Recknagel (7).

bined, the average rings per inch is calculated for each diameter class in the appropriate groups, and, from these figures, the number of years required to grow from one diameter class to the next, and the increment per cent, by Pressler's Formula, are calculated.

In order to get figures that have a consistent trend it is necessary to plot the calculated increment per cent. The points are then averaged by curving, and the increment per cent is read from the curves and recorded.

It is possible to apply the increment per cent figures to a stock table, and compute the increment in terms of cubic feet and cords per acre. The figures thus obtained are suitable for growth calculations and are the more readily understood by the layman if they are used with the growth per cent.

Results

A growth study of spruce and fir wa first made on the Adirondack lands o Finch, Pruyn & Co., Inc., in 1923 (2) Likewise growth figures were publishe by Recknagel (6); and Belyea (1). I the following tables, the results of th 1923 study are compared with those o the recent study. Table 1 shows the num ber of years required to grow the las inch in d.b.h., 1931, and Table 2 the cur rent annual increment per cent for each type, 1931. Tables 3 and 4 compare th 1923 and 1931 figures for number o years to grow the last inch d.b.h. and cur rent annual increment, in the softwoo flat; the groups refer to the land classifi cation (7). In some respects the result are not strictly comparable, due to a slightly different method of obtaining th

Table 2

CURRENT ANNUAL INCREMENT PER CENT IN VOLUME
DATA FROM GROWTH MEASUREMENTS—1931

	B: Lower slope		C: Softwood flat			D: Swamp		E: Hardwood land		
D. B. H.	Virgin	"Old chop"	"Old chop"	Second growth	Girdled	"Old chop"	Second growth	"Old chop"	Second growth	Girdled
Groups	B1 and B2		C1, C2 and C3			D1		E1 and E2		
					Spruce					
6	1.5	3.7	2.7	4.2	2.6	1.6	3.2	2.1	4.4	2.4
7	1.6	3.6	2.6	4.2	2.7	1.7	3.2	2.0	4.1	2.7
8	1.7	3.4	2.5	4.0	2.8	1.7	3.1	1.9	3.8	3.0
9	1.7	3.1	2.5	3.9	2.8	1.7	2.9	1.8	3.5	3.1
10	1.6	2.8	2.4	3.7	2.8	1.7	2.7	1.8	3.3	3.2
11	1.5	2.4	2.4	3.4	2.7	1.6	2.6	1.8	3.2	3.0
12	1.4	2.1	2.3	3.1	2.6	1.5	2.3	1.8	3.0	2.7
13	1.2	1.8	2.2	2.8	2.6	1.4	2.1	1.8	3.1	2.5
14	1.1	1.5	2.2	2.4	2.4	1.3	1.9	1.8	2.9	2.2
15	.9	1.3	2.1	2.0	2.3	1.1	1.6	1.7	2.7	—
16	.8	1.1	2.0	1.5	2.2	1.0	—	1.6	—	—
					Balsam					
6	—	2.8	2.6	4.6	3.3	2.1	4.3	7.5	4.9	2.7
7	—	2.8	2.7	4.5	3.7	2.3	4.2	6.8	5.0	2.6
8	—	2.7	2.8	4.4	4.0	2.4	4.0	6.5	5.0	2.5
9	—	2.6	2.8	4.2	4.2	2.4	3.6	6.2	4.9	2.4
10	—	2.3	2.7	4.0	3.8	2.2	3.3	5.4	4.5	2.2
11	—	1.9	2.4	3.7	3.2	1.9	2.8	4.5	4.0	2.0
12	—	1.6	2.1	3.3	2.6	1.7	2.3	4.0	3.4	1.6
13	—	1.3	1.9	2.8	—	1.5	2.0	3.3	2.8	—
14	—	1.0	1.7	2.4	—	1.3	1.7	3.0	2.2	—

ata and computing it, but, in the main, ne figures show a difference that is due o an actual difference in the growth. The 931 data indicate a more rapid growth n the older spruce than does the 1923 tudy; balsam evidently had a greater increment during the period before 1923.

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Table 3

COMPARISON OF 1923 WITH 1931 DATA—YEARS TO GROW LAST INCH D. B. H. SOFTWOOD FLAT

D. b. h. Inches	"Old chop" 1923	"Old chop" 1931	Second growth 1923	Second growth 1931
		Spruce		
6	15.5	18	15.5	10
7	14.5	13	14.5	7.5
8	13.5	13	13.5	7.5
9	12.5	12	10.5	7.5
10	11.5	12	8.5	7.5
11	10.5	10	7.5	7.5
12	10	9	7.5	7.5
13	10	8	7	7.5
14	10	8	7	7.5
15	10	7	7	7.5
16	10.5	6	—	—
		Balsam		
6	11	14	7.5	8
7	11	12	7.5	7
8	11	11	7.5	7
9	10.5	11	7.5	7
10	10	10	7	7
11	9.5	10	6.5	7
12	9.5	9	6.5	7
13	9	9	6	7
14	8.5	9	6	7
15	8	8	6	7
16	7.5	8	6	—

Table 4

COMPARISON OF 1923 WITH 1931 DATA—CURRENT ANNUAL INCREMENT PER CENT SOFTWOOD FLAT

D. b. h. Inches	"Old chop" 1923	"Old chop" 1931	Second growth 1923	Second growth 1931
		Spruce		
6	2.1	2.7	2.9	4.2
7	2.3	2.6	3.0	4.2
8	2.4	2.5	3.2	4.0
9	2.5	2.5	3.4	3.9
10	2.6	2.4	3.7	3.7
11	2.5	2.4	3.7	3.4
12	2.4	2.3	3.4	3.1
13	2.2	2.2	3.1	2.8
14	1.9	2.2	2.9	2.4
15	1.7	2.1	2.7	2.0
16	1.6	2.0	2.6	1.5
		Balsam		
6	3.1	2.6	4.5	4.6
7	3.2	2.7	4.6	4.5
8	3.3	2.8	4.7	4.4
9	3.2	2.8	4.7	4.2
10	3.1	2.7	4.7	4.0
11	2.9	2.4	4.3	3.7
12	2.6	2.1	3.8	3.3
13	2.4	1.9	3.2	2.8
14	2.3	1.7	2.6	2.4

BRIEFER ARTICLES AND NOTES

A Proposed Revision of Standards for Determining Density of Herbaceous Plant Cover

The detailed study of herbaceous plant populations for the purpose of determining such things as both progressive and retrogressive plant succession, increasing or decreasing grazing capacity of ranges, effects of cover on water run-off and soil erosion, necessarily involves the density of the vegetation, that is, the part of the ground surface that is occupied by the plants.

Various methods have been employed to determine the density factor. In the more detailed work of range research and investigations, the charted quadrat in its various forms undoubtedly has been the method most widely used. Next in importance probably is that of diameter measurements that are converted into plane-surface areas.

In the employment of the quadrat method, it is believed that the most general practice has been to chart the plant structure as it occurs at one-inch above the surface of the surrounding soil. Likewise, it is thought that the usual standard in making diameter measurements has been to take them at one-inch above the ground. However, McGinnies[1] states that, "The area drawn on the map should represent the basal area of the plant at the ground level. With such plants as Antennaria and Phlox, it may be advisable to sketch the outlines of the plants. Other prostrate plants such as Leontodon are best represented as dots or by drawing the circumference of the root crown. The basal area of grasses and the taller weeds should always be used." In my opinion, records made by using either of these standards often will not give the results that are desired and contemplated. It is believed that the record we should have, at least in most cases, is one showing the location and area of the plant surface that produces aerial growth, that is, forage. That area essentially is the maximum spread of the root crown that occurs above ground. Usually it is desirable to record also any dead areas of root crowns.

If it is agreed that aerial root-crown area is what we want to measure and record, then it is obvious that neither the "one-inch-above-ground" or the "ground-level" standard is correct because the maximum root-crown area does not occur uniformly at either of these heights or elevations. Especially in some bunch-grass species (such as *Festuca arizonica* and *Muhlenbergia montana*) that area often is 3 or even 4 or 5 inches above the surrounding soil surface. On the other hand, the top of the root-crown of such a sod grass as *Bouteloua gracilis* occasionally is less than one inch above the ground. An extreme example of the latter condition is *Antennaria microphylla*. The actual surface cover of that plant is represented by its root-crowns or mats of basal leaves which often are not more than one-half inch high so that a chart or measurement at one-inch elevation would record nothing but the flower stalks. McGinnies' method would result in a good record of such plants provided the root-

[1] Wm. G. McGinnies, "The Quadrat." Journal of Forestry, Vol. 28, p. 25. 1930.

rown area is recorded and also the outlines of the plants sketched. Sometimes, specially in seriously eroded soils, the "one-inch" or the "ground-level" standard would result in recording root areas that might be several times less than the actual root-crown or forage-producing area.

In view of the above stated facts, it is suggested that quadrat charts, diameter measurements and other records and measurements of the density of herbaceous vegetation be such as to measure or record the maximum area that produces aerial growth without regard to the height above the surface of the ground that the records or measurements are made. In the case both of broad-leaved herbs and grasses, it is believed the point of measurement should be at the maximum spread of the root-crown that occurs above ground.

Also, it is believed that the method proposed would give a definite standard that would be uniformly interpreted, thus doing away with some of the uncertainties in the methods used in the past and, therefore, go a long way toward eliminating mistakes and discrepancies due to the personal equation. The latter is recognized by all range investigators as a very potent factor that may be of such proportions as practically to nullify the values that there might be otherwise in comparing records that are made by different persons, especially when the records being compared extend over a period of years.

D. A. Shoemaker,
U. S. Forest Service,
Albuquerque, N. M.

Notes on Arizona Pine and Apache Pine

Both *Pinus arizonica,* commonly known as Arizona pine and *Pinus apacheca,* locally called Arizona longleaf pine, (the U. S. Forest Service check list name is Apache pine) are beginning to attract notice in several quarters. Several years ago C. C. Robertson now with the South African Forest Service, made a trip through the Southwest into Mexico. From his notes and observations of the different species studied he thought that both these species might have possibilities for reforestation purposes in South Africa. During the past few years several shipments of seed were sent to that country for planting purposes. Some of the research workers in Arizona and California are also interested in these species in an experimental way—especially in *P. arizonica.*

Although the botanical description and range of these pines can be found in several publications further information has been acquired while obtaining seed from these species which may add to our general knowledge concerning them.

Both species have had a varied and precarious struggle for recognition since they were first noted, from 40 to 60 years ago. They have been dubbed varieties of *Pinus ponderosa,* as various new species, and, at times and by some authorities, were completely ignored—not even considered as a variety.

Arizona pine (*P. arizonica* Engelm.) has also been known as *P. ponderosa var. arizonica* Shaw. One striking feature of this species is that, although belonging to the "yellow" pine group, it has 5 needles to the bundle; occasionally there are 3 but it is essentially a 5-needled pine. Growing quite well scattered through the mountains of southern Arizona and into New Mexico, at elevations of from 7,000 to 8,000 feet, it seldom occurs in large stands. Its growth is extremely rapid when young and, on the deeper-soiled flats which seem to be its natural site rather than the slopes, it often grows into an excellent timber tree containing 2,000 board feet or more—trees with a d.b.h.

of from 30 to 40 inches and a height of from 5 to 7 logs. The cones are from 2 to 2.5 inches long, opening moderately early in the season (October and November) depending upon the elevation and latitude. Unopened, ripe cones picked from the tree will open quickly and fully with either sun or artificial heat. The seed is slate grey in color.

Arizona longleaf or Apache pine, *P. apacheca* Lemmon, has at various times been called *P. latifolia* Sarg. and *P. mayriana* Sud. Sargent in his *Silva* differentiates between *P. mayriana* and *P. apacheca,* thus: "leaves narrower and a little shorter than mayriana. - - - -" Both Sargent and Britton consider it a form of *P. ponderosa* but at present it seems to be accepted as a distinct species. Although Sudworth gives its range as southern Arizona and southwest and north central (Carson National Forest) New Mexico, it is seldom seen, in the United States, beyond the confines of southern Arizona. Even here it is found only in small amounts and growing at the lower elevations. In the Chiricahua Mountains it grows at 7,000 feet just above the Chihuahua pine (*Pinus chichuahuana* Engelm.). *P. apacheca* is usually a rather scrubby, short-bodied tree and seemingly has few if any good qualities unless it be its ability to thrive on dry, rocky sites—both slopes and flats. It must be remembered that the United States is the northernmost range for both of these species. They are much better and more valuable trees, farther south, in Mexico. Coarse needles, from 14 to 16 inches long, growing in tufts at the ends of stout twigs are characteristic of *P. apacheca.* The cones are from 3 to 5 inches long and slow to open either on or off the tree. Unopened cones have been picked in January which were as tight and green as in October. Several bushels of cones picked during the last half of November showed little if any browning. Kiln extraction failed to open them more than 75 per cent. The cones are exceedingly pitchy, more so than any of the southeastern pines. A kiln heat of from 100 to 120° F. often causes the resin to gather in large drops and almost run from the cone. The seed is slate grey in color resembling that of *P. arizonica* except that it is a trifle larger.

Table I gives cone and seed data for the two species. These figures show that the seed of both species has a low per cent of soundness and that the amount of seed obtained per bushel from *P. apacheca* is below the average while that from *P. arizonica* is above the average compared with southeastern pines. This difference between the two is largely due, no doubt, to the difficulty with which the cones of the Apache pine are opened.

Arthur D. Read,
College Station, Texas.

Table 1

SEED DATA ON ARIZONA AND APACHE PINES

Species	Green cones per bushel (number)	Weight of green cones per bushel (pounds)	Seed per bushel (pounds)	Per cent soundness of seed after cleaning	Number of seed per pound	Weight of seed per bushel (pounds)
Pinus apacheca	162 (average of 2 bushels)	37	0.42	82	9,970 88 per cent sound	46
Pinus arizonica	235 (average of 2 bushels)	38	1.00	85	11,113 88 per cent sound	46

Delta Portion of Mississippi Survey Completed

The Forest Survey field work in the 4,425,000 acres in the Delta Bottomlands of Mississippi was completed August 13, 1932. Starting at the Mississippi River at a point five miles south of the Tennessee-Mississippi State Line, 19 survey lines were run at 10 mile intervals. A total of approximately 727 miles of line were run by three field crews and 5,815 sample plots were taken. The forest land in the Delta between Vicksburg and the Tennessee line comprises less than 40 per cent of the total land area. The crews encountered trying conditions during July and August, with extreme temperatures, hordes of mosquitoes and red bugs, and vast areas of cut-over land restocked to poison ivy, trumpet creeper, blackberry briars and some tree species. In spite of these handicaps the work was completed several weeks ahead of schedule. The final computations of areas and volumes are being carried on at New Orleans. The field crews have transferred their activities to the shortleaf pine-hardwood region of northern Mississippi.

G. H. Lentz,
Southern Forest Experiment Station.

More About Bark Blazers

In the April, 1932, number of the Journal, R. E. McArdle described, with illustrations, a bark blazer to be used in marking trees on sample plots. Unquestionably such a tool is needed. It is far superior to chalk, used either in the stick or as powder in a small sack, and is better than lumberman's "keel." Neither chalk nor "keel" leaves a sufficiently permanent mark to allow for checking after a lapse of a week or even less, and both are absolutely useless on the rough bark of some of the southern hardwoods. McArdle's bark marker was tried by the Forest Survey crews working in the Mississippi Delta and in the southern pine region but did not prove entirely satisfactory, because, (1) The cutting face is too wide for trees having rough, hard bark, such as red, black, or water oak; (2) The cutting face is not protected and if sharp enough to do its work is too sharp to carry loose in a cruising coat; (3) The iron handle is unnecessarily heavy.

Various types of bark markers used in Sweden have been tried by our field crews but have not stood up under the hard use involved in marking southern hardwoods. The blades are too thin and too highly tempered and have snapped off when used on rough bark.

In order to get an instrument suited to the Survey's needs I made certain suggestions to the Council Tool Company of

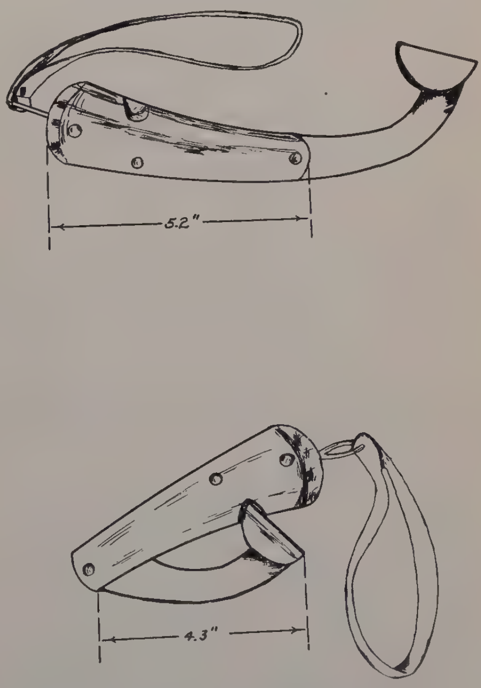

Fig. 1.—Two views of the bark blazer described by Mr. Lentz, open and folded.

Wananish, North Carolina, which specializes in the manufacture of all sorts of tools used in wood's work and has developed various "hacks" used in the naval stores industry. As a result this company has developed a tool that has a cutting edge similar to a gouge and very similar to the cutting edge of an "O-O" turpentine hack. When not in use this tool folds up in jackknife fashion so that the cutting edge is protected by the handle. The handle is large enough to provide a firm grip but is so light that the whole tool weighs only eight ounces. It has a large "nub" at the end similar to that of an ax handle. A leather strap attached to the handle permits hanging the tool from the wrist where it does not interfere with the use of calipers or diameter tape. The steel blade is one-eighth inch thick and the cutting face or gouge is set at an angle to the handle so that there is no tendency to scrape one's knuckles. The construction of the tool and its dimensions are shown by the accompanying sketch. When folded the tool measures 5.2 inches in length.

This instrument costs somewhat more than McArdle's marker. It can be bought for about $4.00 each if ordered in dozen lots.

G. H. Lentz,
Southern Forest Experiment Station.

Names Changed and New Units Created in National Forest System

In the past two years several new national forests have been created and the names of several old forests have been changed. Several forests also no longer exist as separate entities, their areas having been divided and added to adjoining forests. At the request of the Journal of Forestry the Forest Service furnished the following list summarizing the changes:

California National Forest, Calif., changed to Mendocino National Forest, July 12, 1932.

Colorado National Forest, Colo., changed to Roosevelt National Forest, May 26, 1930.

Crater National Forest, Ore., changed to Rogue River National Forest, July 9, 1932.

Shenandoah National Forest, Virginia, changed to George Washington National Forest, June 28, 1932.

Cibola National Forest, New Mexico, created from Manzano National Forest and part of Datil National Forest, December 3, 1931.

Green Mountain National Forest, Vermont, created April 25, 1932.

Hiawatha National Forest, Michigan, created January 16, 1931.

Huron National Forest, Michigan, created May 17, 1930.

Marquette National Forest, Michigan, created February 12, 1931.

Osceola National Forest, Florida, created July 10, 1931.

Ottawa National Forest, Michigan, created January 27, 1931.

Beartooth National Forest, Montana, name dropped and area divided among other forests, December 16, 1931.

Datil National Forest, New Mexico, name dropped and area divided between Cibola and Gila National Forests, December 3, 1931.

Jefferson National Forest, Montana, name dropped and area transferred to Lewis and Clark National Forest, April 8, 1932.

Madison National Forest, Montana, name dropped and area divided among other forests, December 16, 1931.

Missoula National Forest, Montana, name dropped and area divided among other forests, December 16, 1931.

SHADES OF PAUL BUNYAN

It may be of interest that bull-team logging was still practiced in Oregon as recently as 1927. Walter Lawhorn, Cook County, Oregon, opened an operation on Elk Creek, a tributary of the East Fork of the Coquille River in 1925 for the selective logging of Port Orford cedar. Four splash dams were constructed on Elk Creek to project the logs out into the East Fork, from whence they traveled with the aid of more dams and freshets into the North Fork, eventually being caught in the booms on the Coquille River at Coquille.

Mr. Lawhorn, with characteristic loggers' versatility, employed a wide assortment of machinery and logging methods. He used an old spool donkey, a modern high-speed steam machine, several small gasoline donkeys and a "sixty" caterpillar tractor.

In 1926 he brought in five yoke of bulls which he used on the road haul—taking the logs away from the gas donkeys. The bulls worked on a one-half to three-quarter mile skidroad and would haul turns of logs averaging 1,000 board feet per yoke.

According to Mr. Lawhorn, this method of transportation was "broken down" about a third of the time on account of sore feet. Shoes were made and nailed on the bulls to alleviate this, but did not entirely solve the problem. It is his opinion that present day cattle are too finely bred to make good work animals. His near-leader and mate were old-timers and stood the strain. They were about fifteen years old and had logged before on Davis slough.

All of this team of ten were not bulls—the leaders were both steers. They make better animals for heading the team than do the bulls.

In all, about a million feet of cedar were hauled with the animals. As the length of haul increased they were supplanted by a gasoline locomotive—another unique device.

Originally this was a Fordson tractor mounted on four huge double-flanged wheels which somewhat resemble a straw-drum. Two wheels were driven. Later the frame was lengthened, a Climax motor installed, and all four wheels driven. The wheels are about four feet in diameter and thirteen inches wide. The flanges were long, making a deep throat. Poles up to 12 and 15 inches in diameter were laid for rails. The locomotive would careen along at 15 miles per hour if permitted, but the riding was so rough that the operator was willing to proceed quite cautiously. Cars equipped with similar wheels were used to haul the logs. Mr. Lawhorn still has this engine, and though clumsy in appearance its operation was very satisfactory, he says.

C. WELDON KLINE,
U. S. Forest Service.

"LIGHT BURNING"

Light burning, what it is, how it injures the forest and the soil and affects grazing and insect infestations, is succinctly described in the *Forest Rangers' Catechism* by R. W. Ayres and W. I. Hutchison, U. S. Forest Service, as follows:

"Theoretically, light burning means the burning of the surface of the ground to rid the forest floor of litter and thereby reduce the fire hazard. In actual practice, however, when the ground litter is damp enough to allow the fire to burn the surface only lightly, fires will run very slowly or not at all. To secure the results which the 'light burners' desire, that is, a 'clean burn,' the forest cover and ground litter must be so dry that any fire set will destroy not only the

ground litter but all of the small trees and reproduction which forms the basis of the future forest.

"The policy under which national forests are administered by the Forest Service is to protect and wisely use the water, wood, and forage resources of the forests in such a manner as to insure the permanence of these resources. With this idea in mind, backed by 25 years of field experience in fire fighting, the Forest Service has proved that in the long run fire prevention and not 'light burning' is the best system for protecting and conserving our rapidly disappearing forest resources.

"Repeated experiments have shown that it is both impracticable and expensive to light burn large areas of forest land. For example, to light burn the 12,000,000 acres of timber and brush land in the national forests of the California region would cost, even at the low figure of 50 cents an acre, $6,000,000 annually —an amount six times as great as the present yearly expenditures by all Federal, State, and private individuals for fire prevention and suppression in all forest, brush, and range lands in California.

"Light burning causes serious damage to the most valuable veterans of the forest stand by burning them at the base and causing 'cat faces'—a loss that amounts to several dollars per acre in merchantable timber every time a fire runs through the forest. In addition, the little trees and saplings which are the basis of the next forest crop are killed outright, and after the burning of the top soil and humus, the land is invaded by worthless brush which makes the reestablishment of the forest more difficult. The brush is never entirely killed by these fires, and each light burn makes more fuel for a later and more destructive fire.

"Light burning the forests will not keep down pine-beetle infestations. Entomologists have proved that the pine beetles and other destructive insects which live in green, not dead trees, are increasingly attracted to burned areas and readily attack and destroy trees weakened by repeated fires. Experiments have shown that when an area has been burned over, the volume of merchantable timber destroyed by insect attack increases 250 per cent the first season following the fire, also that the wood beetles of which the old-timers talk so much are in reality not destructive to green timber but live in dead and fallen trees and logs.

"Periodic burning at first increases the stand of forage plants, but extensive experiments have shown that if this practice is continued, the noxious weeds and shrubs, which are more hardy than the forage plants, will soon take possession of the range and turn it into a weed and brush patch. Repeated fires eventually destroy or seriously reduce the productivity of valuable range lands, as is well illustrated by the hundreds of thousands of acres of worthless brush range along the borders of the great interior valleys.

"Light burning injures the productivity of the soil. The humus or vegetable litter is destroyed, the soil is left exposed to rain, erosion follows, and the mineral salts necessary for plant growth are washed away."

A New Public Forest

The gift by H. C. Thompson of Oaklawn, St. Tammany Parish, Louisiana of two tracts of forest land, containing 170 and 255 acres respectively, to the 4-H Agricultural Clubs of his parish is probably a land-mark in forestry. So far as is known this is the first donation of forest land as an endowment as well as for demonstration purposes. It is a gift of both land and timber and the extent to

which it proves its profitability and provides funds for the higher education of 4-H club members will be entirely a reflection of the success attending the management of the area.

The first tract of 170 acres is enclosed in a hog-tight fence five feet high. The area was the scene of experiments by Mr. Thompson in both direct seeding and planting of longleaf pine. At present there are about 100,000 planted longleaf pines on the area while a good stand of slash pine occupies the remainder of the tract. This tract is typical of the Lower Gulf region of sandy soils not any too well drained. It is an ideal slash pine site and slash pine will doubtless constitute the final stand. Mr. Thompson's own interest in longleaf pine is responsible for the planting of that species. A gravel road is now being built past this tract.

The second tract is about a mile and a half from Lacombe and a like distance from the railroad. This tract is similar to the first in soil character but has the benefit of much better drainage. A gravel road passes through the area and there is a frontage of one-fourth mile on Bayou Lacombe. Bayou Lacombe is navigable and flows into Lake Ponchartrain, two miles away. The Bayou frontage is marsh land which can be trapped for muskrats and mink. Fishing too is very good and there are several splendid camp sites. The timber is a mixture of slash and loblolly pines with the former predominating. The seed trees of both species are still standing. At present the saplings average from 20 to 30 feet in height. Mr. Thompson is having them thinned, the slash pine being favored. (Incidentally the work is a form of unemployment relief as a man who would otherwise be dependent on charity is doing the work at a very low cost.)

Plans for handling the tracts are still in the formative stage. The aid of the U. S. Forest Service, particularly of the Southern Forest Experiment Station, the Louisiana State Division of Forestry, and the forestry department of the Louisiana State University have been requested in the development of management plans. The area will be used for experimental purposes as well as for demonstration and education. The intention of the recipients is to emphasize the financial side of the gift as strongly as consistent with good forestry practices. The final responsibility for the development and use of the area rests with the Agricultural Service and provides it with a real challenge.

ROBERT MOORE,
Extension Forester,
Louisiana State University.

SYRACUSE RECEIVES LARGE TRACT

A large gift of forest land has been made by Archer Milton Huntington and his wife, Anna Hyatt Huntington, of New York City, to the New York State College of Forestry at Syracuse, N. Y. The forest will be known as "The Archer and Anna Huntington Wild Life Forest Station."

The area embraces fourteen parcels of Adirondack forest land and lakes, aggregating more than 13,000 acres, located principally in Essex County and partially in the Town of Newcomb. The forest is accessible from the Newcomb-Long Lake highway near Rich Lake.

The land will be used for experiment and research in relation to the habits, life histories, method of propagation and management of fish, birds, game food and fur-bearing animals by the Roosevelt Wild Life Station at the College of Forestry and also by the College directly in the promotion of forestry as an aid to game management.

Pacific Coast Spruce-Hemlock Area Preserved

A tract of some 1,400 acres of magnificent forest of the Sitka spruce-western hemlock type has been spared from the axe or other disturbance for all time to come by a recent act of the U. S. Forester, R. Y. Stuart.

The area set aside will be kept forever in its natural state for educational and research purposes and will be known as the Quinault Natural Area. It lies within the Olympic National Forest on the Olympic highway at the south approach to Lake Quinault, in Washington.

The tract contains some of the finest specimens of Sitka spruce to be found in the few remaining stands of old growth in this timber type, according to T. T. Munger, Director of the Pacific Northwest Forest Experiment Station. Some of the best Sitka spruce timber obtained by the federal government for airplane construction during the world war was cut from adjoining lands.

Unemployed Used for Reforestation

The Columbia National Forest, in Washington, ran the largest planting project in the spring of 1932 that has so far been carried on in Oregon and Washington.

All together, 1,600 acres were planted at a total cost of $8,741.10, not including cost of trees. The 956,000 trees planted cost f. o. b. Wind River Nursery $5,782.82 making the total cost of the project $14,523.92.

Approximately 110 men were established in 3 different camps approximately 2 miles apart. All of the men were from the unemployed class and all had dependents. Supplies and equipment were carried into the first camp by means of a tractor and trailer. From this camp everything had to be packed out by pack string to the other two camps.

Detailed costs of the project on a per acre basis are approximately as follows:

Planting	$1.929
Mess	1.198
Transportation	.970
Supervision	.640
Equipment	.398
Rodent poisoning	.059
Mapping	.041
Making and breaking camp	.228
Total cost planting	5.463
Cost of trees	3.614
Total cost	$9.077

The cost per meal was $ .321
Cost of food alone was $ .21

Geo. A. Bright,
U. S. Forest Service.

Portuguese Forester Completes Study in United States

Francisco de Santos Hall, assistant professor of forestry in the University of Lisbon (Portugal), who has been studying American forestry for a year, left Washington today for Lisbon to resume his professional duties. Professor Hall had been awarded a government fellowship and used his leave from the university to observe scientific methods employed by the Forest Service and other bureaus of the United States Department of Agriculture.

Most of his time here was spent with the Research Branch learning the construction and use of volume tables for estimating timber stands. He collaborated with Francis X. Schumacher of the Forest Service in this work and also took several trips into Eastern and Southern forest regions, including an extensive tour of the naval stores producing forests of Florida.

Professor Hall says the homeland forests of Portugal are sufficiently extensive to supply most of the timber and naval stores requried by the Portuguese market. Portugal has immense reserves of tropical woods in the Angola and Mozambique colonies in Africa. The nation also has an extensive trade in forest products with Brazil, with which large South American country it has close racial and linguistic ties.

Portugal imports considerable quantities of pine lumber and hardwood furniture stock and staves from the United States, which in turn buys more than half the Portuguese output of cork. In view of the important and growing exchange of products between the Portuguese-speaking countries and the United States, Professor Hall thinks the study of American forestry should lead to a larger volume of trade in forest products.

The Copeland Resolution

On March 10 the United States Senate passed Resolution 175 introduced by Senator Copeland of New York, which requests the Secretary of Agriculture to submit a report on the forestry situation. The resolution stresses:

1. The threat of early exhaustion of our timber supplies, particularly of softwoods in the East.
2. The large land areas suitable only for forestation.
3. The variety of industrial, economic, and social services in addition to supplying cheap lumber which the utilization of these lands would render as a public domain.
4. The desirability of developing immediately a coördinated federal and state program, and asks
5. That the Secretary of Agriculture advise the Senate whether the federal government should aid the states, together with the facts and reasons on which an opinion is based.

Work on the resolution has been one of the major emergency undertakings in many of the units of the Forest Service since its passage. The changes in the national timber and forest situation during the last decade have been so sweeping and promise to be so far-reaching that the Forest Service has believed that the resolution requires as searching a reëxamination and restatement as time permits of the broad national aspects of our forest problem, and the constructive program or objectives needed for its solution. It has also been believed that both the problem and its solution should be outlined in their full magnitude.

Obviously particular consideration will need to be given to the specific point raised in the resolution regarding federal aid to states, etc. Supporting data will necessarily include the best information which can be obtained on the present and potential forest land and timber and other forest resources of the United States. They will also include as searching an analysis as possible of the progress in forestry to date by the federal government, the states, and by private owners, including among other things results of past and present financial aid from the federal government to the states. It is hoped to submit the findings early in the next session of Congress.

A Letter to West Coast Lumberman[1] from Hon. Franklin D. Roosevelt, Governor of N. Y.

Replying to a request for a clarifying statement as to his views on forestry problems touched on lightly in his accep-

[1]Reprinted through courtesy of the *West Coast Lumberman.*

tance speech at the Democratic National Convention.

State of New York, Executive Chamber,
Albany.
September 6, 1932.

Mr. Miller Freeman,
Publisher, *West Coast Lumberman,*
71 — Columbia Street,
Seattle, Washington.

Dear Mr. Freeman:

This is the first opportunity I have had to answer your letter of July 13th, asking me for a statement of my ideas with respect to reforestation for the benefit of the readers of your publications.

I have used the term "reforestation" to cover all aspects of the protection, conservation and enlargement of our forests, and it is in that sense I understand you make inquiry. As I indicated in my acceptance address, I believe that the care and enlargement of the forests of the Nation offer a promising and profitable field for the employment of idle men. In the State of New York we were able this year to give short-time employment to 10,000 men in our forest tree nurseries and in tree planting. They were recruited from the rolls of the needy unemployed. We have given work to several thousand more in forestry activities, such as trail and road building and similar improvements in the State Parks and State Forests. We have found that the work done in this way with emergency labor under competent direction is efficient and a sound expenditure of public funds. It is entirely out of the class of the ordinary "made jobs" devised to meet the unemployed emergency.

I think it will be sound economy for the Federal government to encourage similar activities in other States under a loan plan perhaps by the government coupled with direct assistance from the States.

In the vast national forests there is opportunity and need for a greatly increased program of improvement. This would give work to many thousands of men during the present emergency. One of the prime needs is for road and trail building for fire protection and funds for this purpose would, in my judgment, be a wise expenditure to be classed as dividend-paying capital investments. There is also in these forests the opportunity for tree planting and improvement cuttings. When we have emerged from the present depression, we will be able to do such work as cheaply and effectively as it can be done now.

Apart from the present emergency I think we need a more definite and comprehensive national plan for protecting, conserving and enlarging our forest resources. This plan should have among its objectives more effective stabilization of the forest products industry. The excellent program adopted this year by the Society of American Foresters needs to be translated into more effective coördinated action by individual forest owners, the several states and the Nation. We need also, as I have said on other occasions, a soil survey of the entire nation and a national land-use program. This has an important bearing on reforestation, which must be jointly a State and Federal concern, but with more effective encouragement from the Federal government than it has received in the past.

Sincerely,
Franklin D. Roosevelt.

October 19, 1932.

Hon. Franklin D. Roosevelt,
Executive Mansion,
Albany, N. Y.

Dear Governor Roosevelt:

I have just seen in the October issue of the *West Coast Lumberman* your letter of September 6th to the publisher of that Journal on the general subject of reforestation. The Society of American Foresters is highly gratified over your reference to its program. We now have five committees working on definite plans of action for getting into effect the most urgently needed parts of the program. Our objective is to encourage the fullest practicable development of both public and private forestry, both to insure an adequate supply of forest products for the people of the United States and as a means of productive use of very large

areas of land not needed or useful for other purposes. Your support of our program will help immensely to further it.

Very sincerely yours,
C. M. GRANGER, *President.*

Executive Mansion,
Albany, New York.
November 3, 1932.

MR. C. M. GRANGER, President,
The Society of American Foresters,
839 — 17th Street, N. W.,
Washington, D. C.

MY DEAR MR. GRANGER:

I have just returned from a trip through the south and middle west, and want to take a few minutes to acknowledge your letter of October 19th and thank you for your expression of approval of my letter published in the *West Coast Lumberman.*

I believe a great deal can be accomplished by an intelligent reforestation program, both as an aid to unemployment and as a permanent benefit for our citizens of the present and the future.

Yours very sincerely,

FRANKLIN D. ROOSEVELT.

REVIEWS

Principles of Soil Microbiology. By Selman A. Waksman. *Second Edition, thoroughly revised. Pp. xxviii + 894. Plates 15, fig. 83. The Williams and Wilkins Company, Baltimore. 1932. $10.00.*

Only four years have elapsed since the appearance of the first edition of this valuable work, yet so much new experience has been gained in the field of soil microbiology that much of the old text had to be rewritten and new information added to bring it up to date. In general the second edition is like the first and of the same size. There are 34 chapters in four parts: (1) The soil population. Occurrence and abundance of microörganisms in the soil; (2) Isolation, identification and cultivation of soil microörganisms; (3) Chemical activities of microörganisms; (4) Soil microbiological processes and soil fertility.

The second edition has additional value to the forester over the first in that it contains a 24-page chapter specifically on the microbiology of forest soils. This is evidence of the growing interest in forest soils and that considerable information concerning the interrelation between the forest soil and its microörganisms is already available. A perusal of this chapter should convince the forester that his silviculture should have a definite regard for the influence the method of cutting may have upon the behavior of the soil microörganisms. Thrifty forest growth requires active soil organisms. This chapter considers forest soils as to the nature of their organic matter, microflora and microfauna, the decomposition of organic matter, formation of ammonia and nitrate-nitrogen and the evolution of carbon dioxide. Every phase of soil microbiology, in general, is considered in the other 33 chapters.

Each chapter is a nicely organized presentation of the available knowledge on its subject as contributed by the author himself and of others. Hardly a page is without one or more footnote references to literature supporting statements. In this respect the book is of particular value to the researcher, although the text is complete in itself.

The book is a splendid example of good typography, format and binding, particularly considering the book's bulk.

EMANUEL FRITZ.

Höhenkeimer. (Alpine Seeds.) By Wilhelm Kinzel. *Angewandte Botanik Band 14, Heft 3. Pp. 182-193. 1932.*

In his latest communication, Dr. Kinzel points out the peculiar behavior of the seed of certain alpine plants which fail to germinate readily in the lowlands even after exposure to low temperatures and full light. Apparently the simultaneous operation of other factors of the high altitude habitat are necessary, for instance low atmospheric pressure and strong radiation. Cosmic rays may even be influential. Such seeds Dr. Kinzel terms "Höhenkeimer" or "high altitude germinators." Additional notes are given on the combined effect of light and cold or darkness and cold. The author points out the important bearing of the results on storage tests on various kinds of seed.

Where stored seed gradually decrease in germinative energy to zero as determined by ordinary germination tests, the apparent lack of viability may be due to a form of secondary dormancy. In some cases treatment with a combination of light (darkness) and frost will induce germination in such seed. Several cases of periodicity in germination occurred when the course of germination extended over many years. Germination was usually most active in spring. While most of the plants tested have been herbs or shrubs, *Sorbus aucuparia* and *Prunus spinosa* were found sensitive to such combined action. Not only the present paper, but Dr. Kinzel's life work on seeds points to the importance of an accurate knowledge of germination characteristics when evaluating the efficiency of various storage methods.

H. I. Baldwin,
Pennsylvania State College.

Weather and Forest Fire Hazard with Special Reference to the White Pine Region of Central New England. By Paul W. Stickel, Northeastern Forest Experiment Station. *Bull. 153, Massachusetts Forestry Association, Boston, Mass., August, 1932. Pp. 8; illus. 25 cents.*

This leaflet condenses the detailed explanation of measuring forest fire danger, contained in Stickel's *Measurement and Interpretation of Forest Fire—Weather in the Western Adirondacks,*[1] and applies the method to the white pine region of central New England. Both of these publications are important contributions to the development of a science of forest pyrology, to replace the rule-of-thumb and experienced-opinion bases which at present largely govern the practices of fire control.

The leaflet for the white pine region is confined to: (1) A general correlation of humidity, duff moisture, fire hazard, number of fires, and areas burned. (2) A diagrammatic illustration of the precipitation—fuel moisture—evaporation cycle. (3) The correlation of ease of ignition according to duff moisture content. (4) The use of an alinement chart to interpret weather measurements into degree of fire hazard in eastern white pine. (5) Some examples of everyday use of these determinations. (6) Brief instructions on how to measure relative humidity, and a relative humidity table.

Although the evidence of the effect of weather on inflammability may strike the "old-timer" in the fire game as proving the obvious, the classification of these data into "degrees of hazard" permits the old-timer to do something which his experienced opinion could not do otherwise; namely, to classify danger into high, moderate, low, and none, and to do this consistently and in agreement with other old-timers. The author has not stressed this feature of his work, yet this should appeal to the board of directors of a forest protective organization. The wardens may feel sure that their opinions are always right, but the directors might observe that more consistency among wardens would produce better protection at less cost.

The diagrammatic representation of the water—duff moisture—evaporation cycle, contained in this leaflet, is an ingenious method of showing the place of each of the numerous factors that affect fuel moisture and inflammability. Although this particular diagram indicates a large movement of soil water up into and through the duff, whereas this movement may be far less important than indicated, the dia-

[1]Reviewed in Journal of Forestry, Vol. 30, pp. 769-771. Oct. 1932.

gram should give many readers a more accurate appreciation than they have had of the numerous factors involved. If this diagram is studied carefully by those students of fire weather who attempt to express all of fire danger on the basis of a single atmospheric factor, they may understand better their difficulty in finding any one factor which tells the whole story.

Stickel's tests of ease of ignition of the duff according to its moisture content show danger at considerably higher moisture than has been found for coniferous duff in the Northern Rocky Mountain Region. The difference may be due to the character of the duff, or it may be linked with the fact found by M. E. Dunlap that eastern hardwood duff has a higher moisture content in equilibrium with temperature and humidity than was found for coniferous duff from the west.

The use of an alinement chart to integrate the effects of temperature, humidity, and days since last rain, offers a simple method of rating degree of hazard at fire control stations not equipped to measure fuel moistures more accurately. In the opinion of the reviewer, this is Stickel's contribution of most value in fire control. It permits men at different stations to arrive at the same rating of hazard when their atmospheric factors have been the same; and it permits consistency of rating and terminology by one man at one station, or by several men over a period of years at one station. Without this consistency, accurate comparison of fire danger is impossible between stations or at one station over a period of years. Such comparisons are certain to be fundamental to insurance ratings, to economical protection, and to administrative determinations of efficiency, in the era to come, when forest fire control is built upon the science of forest pyrology.

H. T. Gisborne,
Northern Rocky Mountain Forest & Range Experiment Station.

Correlation and Machine Calculation. By H. A. Wallace and G. W. Snedecor, *Iowa State College Official Publication Vol. 30, No. 4, June 24, 1931. Pp. 1 to 136.*

Foresters who are interested in the application of some of R. A. Fisher's statistical methods to simple, partial and multiple correlation problems should be very much interested in this revision of correlation and machine calculation. In addition to the statistical methods given in the first edition, the authors have included Fisher's methods of testing the significance of simple correlation coefficients and multiple correlation and regression coefficients. A neat self-checking tabular solution—involving very little extra work—of Fisher's method of testing the significance of multiple regression coefficients has been worked out by the authors and incorporated in their tabular solution of the regression coefficients. The authors have also simplified their tests of significance by including in the bulletin a table which gives—for different degrees of freedom and number of variables—the least significant and least highly significant values of simple and multiple correlation coefficients, and the ratio (t) of a beta regression coefficient to its standard deviation. Fisher's method of analyzing variation, or variance as he calls it, is illustrated by concrete examples which show very clearly the relation of this method to multiple correlation. To illustrate "peculiarities of arithmetic or interpretations" not brought out by the data used to illustrate the methods in the text the authors have appended summaries of the results of applying these statistical methods to ten different sets of data.

Any forester who has occasion to use multiple correlation in the analysis of his data will find this publication more than helpful. Bound together with Bruce and Reineke's bulletin on multiple curvelinear

correlation, these bulletins make a complete and excellent multiple correlation manual for the research worker.

R. M. Brown,
University of Minnesota.

Report on the California State Labor Camps. By S. Rexford Black. *California State Unemployment Commission, San Francisco, California. 1932. 47 pages.*

A copy of this report by S. R. Black, should be in the hands of every Governor in the country and those other officers and private individuals who are concerned with or interested in the alleviation of unemployment. It describes how California reduced the length of its bread line by sending some of its unemployed to publicly-operated labor camps in the forests where the men were given shelter, subsistence, clothing and tobacco in return for a maximum of six hours work each day. The plan was admittedly an experiment and only about 3300 men were cared for, but it was such a success that it will be placed in operation again this winter on an enlarged scale.

The underlying theory of the California plan is that the average unemployed man is willing to work if given the chance and that if he cannot work for a wage he is willing to work at least for his bed and board.

California had to meet the problem of caring for, not only its own unemployed, but in addition a horde from other states that doubtless was lured on by the prospect of a more equable winter climate.

In all, 28 forestry camps and 2 highway camps were operated. The men in the forestry camps built 504 miles of firebreaks and roads in addition to other miscellaneous fire hazard reduction work such as cleaning up inflammable debris around recreation sites, along highways, etc. A total of 200,399 man-days' relief in the forestry camps cost the state $109,-893 or approximately 55 cents per man per day. The men were recruited through various charitable agencies in the cities. "Only volunteers were accepted in the camps, but after reaching camp, each man was required to work, or leave." The men were housed in tents in some cases and in others in buildings such as unused logging or construction camps. Medical attention was provided through a first-aid man in each camp. Food was of standard construction camp and logging camp kind; camp officers ate at the same table and of the same food as the workers. The camps were operated from December 1 to early in April.

The author, S. Rexford Black, a member of the Society of American Foresters, Secretary of the California Forest Protective Association and recently appointed Chairman of the State Board of Forestry, served as chairman of the Governor's State Labor Camp Committee. He is regarded as the "father" of the state labor camp plan. The report gives just the bare facts of the establishment and organization of the camps; Mr. Black might well have gone further and discussed their social aspects. These impress the reviewer as follows:[1]

Operation of the camps has emphasized some very important factors which should be of interest to all concerned in social welfare work. The camps took jobless men off the streets, away from the necessity of begging and away from the pernicious influence of the psychology of the disgruntled mob. They gave the men a healthful outdoor occupation that kept them physically and mentally fit and self

[1]*See also* "Camps for the Unemployed in the Forests of California" by R. L. Deering. Journal of Forestry, Vol. 30, No. 5, pp. 554-557. 1932.

respecting. The camps attracted only the better class of the jobless. The genuine bum stayed away from a camp where he is expected to work; more than that, when the news spread eastward that indigents in California were being sent to labor camps, the real bum cut his westward journey short. In this respect the labor camp idea really aided relief agencies in sifting the bum from the willing but unfortunate.

The camps were models for discipline. There was no disorder; very little supervision was needed. The camps were self governing, and infractions of rules were dealt with by the men themselves. The men were quite satisfied and there was apparently no feeling among them that the state was taking advantage of their dependence upon it to get work done cheaply.

The forest is a huge reservoir of work that can be tapped at any time without much preparation. Debris piles up, roads, trails and firebreaks grow over, diseased trees menace others, erosion commences in barren spots, etc. All of this requires correction and none of it requires any great degree of skill from the laborers. It requires only simple planning and preparation and no great amount of equipment; its results bring returns in reduced hazard at once; there is no increased expense for maintenance after the work is done, and it can be started on short notice and stopped without loss. In these senses a clean-up job is a better labor project than reforestation. It would take too huge a sum of money to do such a clean-up job if the cost were to be charged solely to the work accomplished, in fact it just would not be done. On the other hand the public care of jobless through charity is also costly and there is mighty little to show for the expenditure except that idle men have been kept idle, herded in large population centers where they become the prey of social agitators. Why not combine the two—keep the men occupied at some work that will stimulate them mentally and build them up physically and at the same time get some needed public improvements accomplished. It is superior to straight-out charity. Unemployment, especially the seasonal kind, is always with us though noticed by the general public only during business depressions. To give the unemployed a dole is as vicious as to starve them. To make a big play at relief only during emergencies is unsound. The forest can take care of the jobless in normal times as well as during depressions. This fact should not be lost sight of. It may be the solution of a large part of our annual unemployment relief problems.

EMANUEL FRITZ.

CORRESPONDENCE

EDITOR, JOURNAL OF FORESTRY.
DEAR SIR:

The Society of American Foresters at its next annual meeting ought to resolve not to resolve on any matters more involved than to compliment, thank or console. Resolutions on other subjects are misleading.

The average layman in reading a resolution (if he pays any attention to it at all) is inclined to believe that it expresses the concensus of the Society formulating it and was arrived at only after due deliberation. This is obviously not the case in so far as the resolutions of our Society's annual meetings are concerned. The meeting of necessity represents only a very minor part of the Society membership and that of the section of the country in which the meeting is held. True, some members from other regions are present, but they are clearly out-numbered.

Resolutions are always hastily formulated unless prepared beforehand by someone particularly interested in some one topic. They are presented to the convention at its last session; some of the members have already left, all are tired, and adequate time for study and deliberation is not available. Their adoption is usually perfunctory and certainly never after serious deliberation.

For instance, at the last annual meeting of the Society a resolution was adopted urging the Bureau of Internal Revenue to reconsider its present ruling that planting costs are a capital investment. The resolution was introduced by a member from Wisconsin where they grant an inequitable subsidy to reforestation by considering planting costs current expenditures.

No one, either on the resolution's committee or on the floor of the meeting, was able to inform the members present the reasons why the federal government and the other income tax states had never adopted this exemption. That there were objections to it was obviously because a member of the Society had sometime ago in the columns of the JOURNAL presented a statement of fact in opposition to this very subsidy. (Vol. 27, No. 8, pp. 989-991, December, 1929.) Time was not available to ferret out this statement and so the resolution was adopted blithely even though we were aware that there was another side to the story that had not been disclosed.

The resolution referred to is an extreme case and perhaps is open to an even more fundamental objection. Should the Society of American Foresters, a professional and technical organization, express opinions as a body on topics outside of its professional field? Probably we will all agree that it would be ridiculous for us to take a stand on such issues as birth control and prohibition, but that any issue which we believe affects forestry or forests, especially if the effect is adverse, is a fit subject for resolution.

However, if we adopt this principle we would, it seems to me, be even justified in resoluting on birth control and prohibition, the former tends to restrict population, hence wood consumption and the latter materially affects the demand for tight cooperage!

It would appear then that we should adopt a more restrictive principle, and if

we must resolve, I for one would confine it strictly to matters of technical forestry.

The importation of Russian pulpwood and the subject matter of the resolution previously referred to are not technical forestry matters, although they do affect forests; the former is in the field of world economics and international trade and the latter is in the field of public finance.

In a democracy of course, we must as individuals formulate opinions on all conceivable subjects, but we do so, or should do so, on the basis of arguments and conclusions reached by specialists and we should not be influenced by resolutions adopted by organizations who are no better fitted than we are to arrive at a technical opinion.

Very truly yours,
P. A. HERBERT,
Michigan State College.

TREE-GROWTH MEASUREMENT

EDITOR, JOURNAL OF FORESTRY.
DEAR SIR:

Reineke has prefaced a recent article[1] dealing with a device for measuring changes in thickness of the outer layers of tree trunks with several statements which call for correction. Attention will be confined for the present to his comments on the dendrograph, with which a total of over two centuries of tree growth have been recorded at Carmel.

When it is said "the pen recording the movement of a system of links which make contact with the tree at opposite ends of a given diameter," it is clear that the essential feature of design, and method of operation of the instrument are unknown to him. As it has been described in six languages in a score of publications no space will be given to a correct description here.

Having made this fundamental failure, Mr. Reineke says "Growth during very short intervals is considerably less than the instrumental error." Outside the errors which might arise from faulty settings the only corrections are those of the temperature coefficient of fused silica and invar, which are far below any practical value. The reader may make his own guess as to the meaning of the sentence "MacDougal has employed a dendrograph capable of measuring and recording variation in tree diameter over a short period of time."

Mr. Reineke need not magnify the defects or the cost of the dendrograph to make a better background for his dendrometer, which, designed to measure changes in the thickness of the outer layers of a tree-trunk is characterized by him as "illustrating a method of eliminating the effects of transpiration pull—"—"non-recording instrument which will accurately measure tree-diameter growth directly." Neither purpose is accomplished.

A more intimate knowledge of the anatomy, hydrostatic and pneumatic system of trees would serve as a guard against such mistakes. Then a consultation of Polansky's recent description of tree-growth measuring instruments, the earliest design of which was published in 1880, would yield many suggestions for improvements in the model presented.

Very truly yours,
D. T. MACDOUGAL,
Desert Laboratory, Tucson, Ariz.

[1]Reineke, L. H. A precision dendrometer. JOURNAL OF FORESTRY, Oct. 1932.

SOCIETY AFFAIRS

Doings of the Executive Secretary October 8th to November 14th

October 27th to 29th, attended the annual meeting of the Ohio Valley Section at Indianapolis, report on which is to be found further on. As is usual at such meetings, the results accomplished are to be measured not only by the speech the Executive Secretary may have made during the formal session and the resolutions passed, but more by the informal personal contact with individual members and small groups on the side lines with whom there is always profitable interchange of ideas as to the proper conduct of Society Affairs. An important by-product of this meeting is an urgent invitation to the Executive Secretary to participate in the coming annual meeting of the Central States Forestry Congress at Louisville, Ky., on November 17th to 19th. This Congress, as its name implies, has heretofore been primarily an annual meeting affair. Plans are now afloat to convert it into the proper sort of a forestry association with a permanent executive staff so that it may perform a very necessary function of supporting and advancing the forestry movement within the territory it covers. The invitation of the Executive Secretary to come and help in the perfection of such a plan was at the instigation of several members of the Congress who are also members of the Society and of the Ohio Valley Section. The opportunity thus offered the Society to extend its usefulness in the advancement of the profession as well as the forestry movement itself will be fully taken advantage of, unless a prospective meeting of the Council should happen to fall on conflicting dates.

Spent October 31st and November 2nd at Ann Arbor, Mich., in conference with Doctor S. T. Dana, Director of the Michigan School of Conservation and Forestry, and members of his faculty. Discussed with them thoroughly, Society affairs and plans for the future. During the morning of October 31st, addressed the Ann Arbor forestry students in a body, on the Society of American Foresters, explaining its part and importance in the forestry scheme of things, and emphasizing the value to them of membership in the Society, after they have become eligible through graduation.

On the evening of November 1st, at East Lansing, addressed the students of the Forestry Department of the Michigan State College in the same manner. Spent Wednesday afternoon and Thursday at East Lansing with Professor P. A. Herbert and members of his staff in the same manner as at Ann Arbor. Spent the morning of November 2nd at Lansing in the Michigan State Conservation Department with Forester Schaaf and other employees of the department who are members of the Society.

Spent the better part of Sunday October 16th in conference with Dean Graves in Washington concerning the Administration's proposed plans for reorganization of the Federal Conservation activities and also the perfection of working arrangements under which the Society could aid in the distribution of the recently published report of the Committee on Forest Education.

On November 12th, attended a joint hearing before the Director of the Bureau of the Budget concerning the Administration's proposed plans for depart-

mental reorganization. The group was composed of the following: O. M. Butler, Secretary, American Forestry Association; G. H. Collingwood, Forester, American Forestry Association; E. G. McCloskey, Representative, National Grange; W. G. Howard, President of the Association of State Foresters; Seth Gordon, President, American Game Association; Chester H. Gray, Washington Representative American Farm Bureau Federation; Doctor W. D'Arcy McGee, Vice-President and Washington Representative of the Izaak Walton League, and Franklin Reed, Executive Secretary, Society of American Foresters. This group, presented to Director Roop, a joint statement outlining the principles that should govern in the disposition of the Federal Conservation activities as covered in "A Plan for Reorganizing the Conservation Work of the Federal Government," and published in the December, 1930 issue of the JOURNAL, and as given in brief by the Executive Secretary in his letter of March 28th to Hon. John J. Cochran, Chairman, Committee on Expenditures in the Executive Departments, House of Representatives and published in the May issue of the JOURNAL, page 647.

The rest of the six weeks' period covered by this report was absorbed in all the various routine duties of the office. In a job like this the little things done, or the sum total effect of them, counts fully as much as the occasional big accomplishments. The continuous correspondence with Society members, especially those in need of new and better employment opportunities; the working out with the President and Council of plans, financial and otherwise, for the future; assistance to the Committee on the Annual Meeting, and to the several other committees of the Society; constant contacts with representatives of other organizations on problems and undertakings of mutual interest; and unremitting attention to administrative detail to insure a continually improving service to the Society and its members at a continually lower cost; all take their toll on the Executive Secretary's time and effort.

FRANKLIN W. REED,
Executive Secretary.

LAST CALL FOR S. A. F. ANNUAL MEETING

Big problems of forestry discussed by big men of the profession will be the lodestone that will attract large numbers of foresters to the 32nd annual meeting of the Society of American Foresters to be held in San Francisco, December 14 to 16. Dean Henry S. Graves of the Yale Forest School, Yale University, will deliver the keynote address, and review the major conservation problem of the nation and set forth the task ahead for foresters. Other nationally known speakers who will discuss pertinent conservation topics on the two open meeting dates, December 14 and 15, are:

"Conservation in the National Government," Major R. Y. Stuart, Chief, U. S. Forest Service, Washington, D. C.

"Parks as a Form of Land Management and Conservation," Horace M. Albright, Director, National Park Service, Washington, D. C.

"The Outlook for Timber Management by Private Owners," Col. Wm. B. Greeley, Secretary-Manager, West Coast Lumbermen's Association, Seattle, Wash.

"Conservation and State Governments," Lewis E. Staley, Secretary, Pennsylvania Dept. of Forests and Waters, Harrisburg, Pa.

"The Place of Recreation in the Forest Program," C. J. Buck, Regional Forester, North Pacific Region, Portland, Oregon.

"The Water Conservation Problem in Forestry," C. L. Forsling, Director, In-

termountain Forest Experiment Station, Ogden, Utah.

"The Timber Problem in Conservation," Prof. Frederick S. Baker, Dept. of Forestry, University of California, Berkeley, Calif.

"Principles of Conservation in the Use of Wild Land," S. B. Show, Regional Forester, California Region, U. S. Forest Service, San Francisco, Calif.

Following the general meetings, one full day will be given over to purely Society affairs and the good of the order. The annual banquet and entertainment, staged in true California Section style, will be held on the evening of December 15. Interesting trips, luncheons and other entertainment are being planned to make the visit of the ladies accompanying delegates one long to be remembered.

Society members and their friends who plan to attend the annual meeting are urged to arrive in San Francisco early in the week so that the two or three open dates prior to the general meetings may be spent in seeing some of the attractions and wonders of the Golden State, listed below:

Yosemite National Park (El Capitan, Glacier Point and Mariposa Grove of Bigtrees)—one and one-half days by auto.

Bull Creek and Dyerville Flats (tallest living tree and heaviest timber stands in the world), Humboldt State Redwood Park—one and one-half days by auto.

Santa Cruz Bigtrees, Monterey, 17-mile Drive, Carmel-by-the-Sea—one and one-half days by auto.

Institute of Forest Genetics, Placerville—one day.

Muir Woods National Monument (giant redwoods) and Mt. Tamalpais, one-half day.

Golden Gate Park and Steinhart Aquarium, San Francisco—one-half day.

University of California, Berkeley (campus, stadium, forest school, California Forest Experiment Station)—one-half day.

Stanford University, Palo Alto (Skyline Blvd., campus, Memorial Church)—one-half day.

Chinatown, San Francisco—2 hours.

Following the meetings in San Francisco the delegates will go to Los Angeles where members of the California Section have arranged special trips into the Angeles and San Bernardino National Forests. Opportunity will here be presented to see highly developed systems of scenic mountain highways, intensive recreational use of forest land, chaparral "forests," so valuable for watershed protection, Mt. Wilson with its 100-inch telescope, orange groves and motion picture colonies.

Foresters, who are also football fans, will have an opportunity to see two great games between eastern and western teams—on December 10 Notre Dame vs. University of Southern California at Los Angeles, and on December 17 Georgia Tech. vs. University of California at Berkeley.

The Society headquarters in San Francisco will be the Hotel Bellevue, 505 Geary St. Request for reservations should be made at once and addressed, preferably, to R. L. Deering, chairman, Reception Committee, U. S. Forest Service, Ferry Bldg., San Francisco, Calif.

October 28, 1932.

Mr. C. M. Granger,
President, Society of American Foresters,
839 — 17th Street, N. W.,
Washington, D. C.

Dear Granger:

At the Logging Congress the other day I talked to Dean Peavy about the meeting of the Society of American Foresters to be held in San Francisco, and asked him whether he would be interested in having the forest school men of the east route their trip one way through the Pacific Northwest.

Peavy and I would be very glad to en-

tertain them at stop-overs in Corvallis and Seattle. I feel sure Miller at Moscow, Spaulding at Missoula, and Schmitz at St. Paul, would all be delighted to have these men stop though I have not had a chance to check up.

If you feel that some of the men could be interested a little notice might be inserted in the announcements that are sent out. Perhaps it would be better for them to come west via the Northwest as they would then be sure to find these schools in session.

Very sincerely yours,
HUGO WINKENWERDER.

UNEMPLOYMENT RELIEF

Please do not forget the Executive Secretary's letter to the Section officers (page 773 of the October JOURNAL) and the word concerning the "Record of Members" (page 910 of the November JOURNAL).

The office is continually hearing from members who have been displaced by the economic upset and are in the market for new connections. The more complete and more up-to-date its records are, for every member, the better able will it be to help. By the same token it needs the fullest possible information concerning new employment opportunities. When any such come to your attention, please report them in immediately. If you can take direct action and yourself make the place available to some fellow member, so much the better. When you do that, please let us hear about it.

FRANKLIN REED,
Executive Secretary.

FOREST EDUCATION BOOK NOW AVAILABLE

"Forest Education" by Henry S. Graves and Cedric H. Guise, and published by the Yale University Press, is a study of the problem of forest education in the United States and Canada, conducted under the auspices of the Society of American Foresters and supported by a grant from the Carnegie Corporation.

The primary purpose of this book is to aid in strengthening the system of forest education in the United States. To this end the authors point out the elements of strength and weakness in the forest schools and suggest measures that would lead to raising the general standard of proportional preparation in forestry.

This 421 page book including bibliography and index, may be obtained from the Society's office at a cost of $2.50 a copy.

ANNUAL MEETING OF THE OHIO VALLEY SECTION

Thirteen foresters from Ohio, four from Illinois, four from Kentucky, twelve from Indiana, and eight from Michigan attended the annual meeting of the Ohio Valley Section which was held in Indiana on October 27-28-29, 1932. Members of the section gathered at the New Highland Hotel, Martinsville, on October 27 and held an evening meeting. On the morning of October 28 the section visited the Morgan-Monroe Counties State Forest and the Brown County State Park. Lunch was served at the new Abe Martin Lodge. During the afternoon the group visited the Jackson County State Forest, the Clark County State Forest, and the State Forest Tree Nursery. The party then drove to Wyandotte Lodge in the historic Blue River section. A short business meeting was followed by technical papers which were presented by Daniel Den Uyl and Ralph K. Day. On Saturday morning the party visited the Cox woods, a fine tract of native timber near Paoli, and the Spring Mill State Park. While at Spring Mill the group visited some tracts of fine hardwood timber and watched the operation of an old "up and down" sawmill.

The 1933 meeting of the section will be

held in Michigan. Shirley W. Allen was elected to serve as chairman and T. E. Shaw was reelected secretary.

T. E. SHAW,
Secretary.

At its two evening business sessions, the Section gave interested attention to Society affairs in general and to Section affairs in particular. The Executive Secretary of the Society was given opportunity to report progress and accomplishments of the Society since April 1, 1930, when it first employed such an officer, and to outline plans ahead. (See President Granger's letter to the members of October 22, 1932.) The ensuing discussions led to the adoption of constructive resolutions:

1. Favoring continuation of the Executive Secretaryship.

2. Suggesting to the Council that it consider the possibility of reducing Society overhead costs by having the Executive Secretary take over the functions of the Business Manager.

3. Urging more active interest on the part of the Society in the problems and difficulties of its members, holding state forester and similar positions, when they are confronted with adverse political influences.

4. Authorizing the Section Chairman and Secretary to appoint a committee to study the methods of the older and more fully organized Sections with a view to developing a plan of organization whereby the Ohio Valley Section may participate more actively in the conduct of Society affairs and the formulation of policies.

(Note—These resolutions would have been printed verbatim, but through some unavoidable slip-up they failed to come in before the JOURNAL had to go to press.)

FRANKLIN REED,
Executive Secretary.

SECTION SECRETARIES ASKED TO HELP

Section secretaries can aid in the more prompt publication of papers read at Section meetings if they will forward them to the Editor before or immediately after a meeting. They are asked also to see that each manuscript is in proper order as to title, author, author's affiliation, leader, date and place of meeting, footnotes, graphs, tables, references, etc. The reading of a paper before a meeting does not give it entry to the JOURNAL pages automatically. It must meet the same test for quality as other contributions. Papers not in good order must be refused.

EMANUEL FRITZ, *Editor*

FORTHCOMING EVENTS

32nd Annual Meeting
Society of American Foresters
December 14-18, 1932
San Francisco, Calif.

Section Meetings

Winter Meeting
New England Section
February 6-7, 1933
Hotel Carpenter
Manchester, N. H.

Section secretaries are welcome to use this box for announcing their meetings. Copy should be in the hands of the Editor or Executive Secretary one month before date of publication.

PERSONALS

Percy M. Barr, who served as lecturer in forest mensuration at the University of California last spring and later returned to his work as forester in charge of the research division of the B. C. Forest Service, has been given a permanent appointment as Assistant Professor of Forestry and took up his duties at the University of California on October 1st. He will have charge of forest mensuration and forest management.

Hugh P. Baker, Dean, New York State College of Forestry at Syracuse University, has been elected to the presidency of the Massachusetts State College at Amherst, Mass. It is expected he will take up his new work about February 1, 1933.

George W. Peavy, Dean, School of Forestry, Oregon State College, as ranking dean at the college has been made permanent chairman of its Administrative Council. In this capacity he will relieve the Chancellor of many administrative details. Under the new organization of the Oregon state educational institution, one man, W. J. Kerr, formerly president of the State College, becomes Chancellor of the five consolidated institutions with headquarters at Eugene, Oregon, the seat of the University of Oregon.

Axel Oxholm, Director of the National Committee on Wood Utilization, suffered an injury on Hallowe'en which at first threatened to be serious. One of a group of small boys, on the customary errand of mischief, hit him in the face with a missile of some sort, broke his glasses and badly cut the ball of one eye. It was a narrow escape, but it is a pleasure to report that Oxholm will be back on the job in another week or ten days with his eyesight very nearly as good as new.

Names Dropped from Membership Roll

The following members have been dropped from the rolls of the Society:

DECEASED

Fellow

Toumey, J. W.

Senior

Ashe, W. W.
Klobucher, Frank J.

Junior

Balizet, Clarence E.
Hash, C. J.
Spelman, Howard R.

Corresponding

Opperman, A.

Honorary

Newell, F. H.
Schwappach, Adam

RESIGNED

Senior

Billings, Roger W.
Elofson, Harry W.
Gery, R. E.
Kellogg, Frank B.
Stadtmiller, L. R.
Schreck, Robert G.
Merritt, R. G.

Junior

Butz, George W., Jr.
Carroll, F. T.
Doster, Clare O.
Eddy, H. J.
Harley, W. P.
Johnston, H. W.
Medley, J. W.
Park, Barry C.
Pyle, E. C.
Woolschlager, T. P.

Associate

Fowler, Frederick H.
Hutchens, F. B.

DROPPED FOR NON-PAYMENT OF DUES

Senior

Averill, W. B.
Crocker, D. A.
Hadley, E. W.
Long, William Henry
Metzger, Homer S.
Sanford, F. H.
Schaaf, Marcus
Stewart, Gilbert I.
Williams, A. S.

Junior

Baker, Charles E.
Basnett, Douglas
Baum, Clayton C.
Beedon, O. L.
Berg, Birger
Bjornstad, Eugene
Booth, I. S.
Bosworth, Henry B.
Brandborg, Guy M.
Briggs, Frank E.
Carson, Kenneth W.
Cavill, J. C.
Commins, M. J.
Dexter, A. K.
Dickson, Bly
Diehl, Jas. N.
Earle, Gilbert C. W.
Eger, B. A.
Ford, R. E.
Forsyth, H. Y.
Hamilton, Neale R.
Herrick, Clinton S.
Howarth, James A., Jr.
Joy, George C.
Kerber, H. M.
Kirkmire, D. F.
Knowles, H. Henry
Koenig, Otto
Lee, Bernard
Lundell, Paul G.
Lynne, V. A.
Mandenberg, E. C.
McCain, A. C.
Millen, F. H.
Mink, Oscar W.
Myers, Remeley E.
Nolen, Earl
Partington, Clyde N.
Peterson, W. A.
Phinney, T. Dean
Pierson, A. H.
Pulling, Albert V. S.
Renner, Ernest A.
Roberts, Kenneth L.
Shannon, Claude C.
Stoner, Donald J.
Streator, Edward J.
Thompson, A. Robert
Turnbull, George A.
Tusler, Henry S.
Weston, J. R.
Weston, Ray Faunce
Yochelson, Albert

Associate

Gilman, H. S.
Waugh, Frank A.

Announcement of Candidates for Membership

The following names of candidates for membership are referred to Junior Members, Senior Members and Fellows for comment or protest. The list includes all nominations received since the publication of the list in the November Journal, without question as to eligibility; the names have not been passed upon by the Council. Important information regarding the qualifications of any candidate, which will enable the Council to take final action with a knowledge of essential facts, should be submitted to the undersigned before January 10, 1933. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered by the Council as strictly confidential.

FOR ELECTION TO GRADE OF JUNIOR MEMBERSHIP

Name and Education	*Title and Address*	*Proposed by*
Baker, J. C. Purdue U., B. S. F., '31.	District Forester, Division of Forestry, Brownstown, Ind.	Ohio Valley Section
Kramer, William P. Penn State, B. F., '19.	Assistant Forest Supervisor, Pisgah, N. F., Asheville, N. C.	Appalachian Section
McKeithen, Togo B. Louisiana State U., B. S., '31; Yale U., M. F., '32.	Unemployed, Urania, La.	Gulf States Section
Peterson, Lyall E. St. Olaf; U. of Minn., B. S. F., '31.	Assistant Field Aide, Bureau of Entomology, Division Forest Insects, Central States Forest Experiment Station, Columbus, Ohio.	Ohio Valley Section

Name and Education	*Title and Address*	*Proposed by*
Richardson, George F., Jr. Trained as Forester by U. S. Veterans Bureau, '20 to '23.	Agent in Charge of District, Blister Rust Control, Dept. of Agriculture, Lebanon, N. H.	New England Section
Tannehill, G. M., Jr. Louisiana State, B. S., '31.	Dry Kiln Marker, Urania Lumber Co., Urania, La.	Gulf States Section

FOR ELECTION TO GRADE OF SENIOR MEMBERSHIP

Bowman, Arthur B. Penn State, B. S. F., '24; Mich. State (incomplete) Mm. Ag. Eng. (Junior Member, 1930.)	Instructor in Forestry, Michigan State College, East Lansing, Michigan.	Ohio Valley Section
Dressel, Karl Mich. State, B. S. F., '23. (Junior Member, 1925.)	Assistant Professor of Forestry, Michigan State College, East Lansing, Mich.	Ohio Valley Section
Genaux, Chas. Penn State, B. S. F., '24; U. of Idaho, M. S. F., '29. (Junior Member, 1927.)	Professor of Forestry, University of Idaho, Pocatello, Idaho.	Intermountain Section
Hall, Ralph C. New York State, B. S. F., '25; Harvard U., M. F., '27; U. of Mich., Ph. D., '31. (Junior Member, 1926.)	Assistant Entomologist, Bureau of Entomology, Dept. of Agriculture, Central States Forest Experiment Station, Columbus, Ohio.	Ohio Valley Section
Kaylor, Joseph F. Penn State, B. S. F., '27; 3 months' European Forestry Tour. (Junior Member, 1929.)	Assistant State Forester, Dept. of Forestry, Indianapolis, Ind.	Ohio Valley Section
Paton, Robert R. Oberlin College, '20-'22; N. Y. State, B. S. F., '25; Yale U., M. F., '26. (Junior Member, 1927.)	Assistant Forester, Dept. of Forestry, Ohio Agricultural Experiment Station, Wooster, Ohio.	Ohio Valley Section
Sawyer, L. E. Michigan Agricultural College, B. S. F., '24. (Junior Member, 1926.)	Extension Forester, Illinois State Natural History Survey, College of Agriculture, University of Illinois, Urbana, Ill.	Ohio Valley Section
Wiesehuegel, Erwin George U. of Mich., B. S. F., '22; U. of Idaho, M. S. F., '29; Ohio State, beginning on Ph. D., '32. (Junior Member, 1927.)	Assistant Professor of Forestry, Dept. of Horticulture and Forestry, Ohio State University, Columbus, Ohio.	Ohio Valley Section

FOR ELECTION TO GRADE OF ASSOCIATE MEMBERSHIP

Cain, Stanley A. Butler U., B. S., '24; U. of Chicago, S. M., '27, Ph. D., '30.	Assistant Professor, Dept. of Botany, Indiana University, Bloomington, Ind.	Appalachian Section Ohio Valley Section

C. F. Korstian,
Member of Council in Charge of Admissions.

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Vice-President, John D. Guthrie, Forest Service, Portland, Oregon.
Secretary-Treasurer, Paul G. Redington, Biological Survey, Washington, D. C.

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The Council consists of the above officers and the following members:

	Term expires		Term expires
Ralph S. Hosmer	Dec. 31, 1933	E. L. Demmon	Dec. 31, 1935
Clifton D. Howe	Dec. 31, 1933	A. F. Hawes	Dec. 31, 1935
Stuart B. Show	Dec. 31, 1933	C. F. Korstian	Dec. 31, 1935
Claude R. Tillotson	Dec. 31, 1933	Hugo Winkenwerder	Dec. 31, 1935

Member in Charge of Admissions

C. F. Korstian

Executive Officers

F. W. Reed, *Executive Secretary*
L. Audrey Warren, *Business Manager*
810 Hill Bldg., Washington, D. C.

Editor, Journal of Forestry

Emanuel Fritz, 231 Giannini Hall, Berkeley, Calif.

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K. E. Pfeiffer, Vice-Chairman, Asst. State Forester, 1411 Fidelity Bldg., Balto, Md.
H. F. Round, Secretary, Forester's Office, Pa. R. R. Co., Philadelphia, Pa.

Appalachian

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George Cecil, Vice-Chairman, Chamber of Commerce, Los Angeles, Calif.
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Intermountain

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Arthur G. Nord, Vice-Chairman, U. S. Forest Service, Salt Lake City, Utah.
G. W. Craddock, Jr., Secretary, Intermtn. Forest & Range Exp. Sta., Ogden, Utah.

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H. C. Belyea, Secretary, N. Y. State College of Forestry, Syracuse, N. Y.

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G. M. DeJarnette, Secretary, N. Rocky Mt. For. Exp. Sta., Missoula, Mont.

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R. E. McArdle, Secretary-Treasurer, 514 Lewis Bldg., Portland, Ore.
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Alfred E. Fivaz, Vice-Chairman, Bureau Plant Industry, Washington, D. C.
Perkins Coville, Secretary, U. S. Forest Service, Washington, D. C.

Wisconsin

H. Basil Wales, Chairman, U. S. Forest Service, Milwaukee, Wis.
A. G. Hamel, Secretary, 4420 W. Wright St., Milwaukee, Wis.

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Art.—article; ed.—editorial; rev.—review; art. (rev.)—review of article or book by; n.—briefer article and note; s. a.—society affairs; cor.—correspondence.